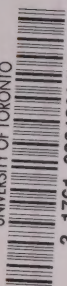


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THE WATERLOO
TIME, COST AND MANPOWER STUDY
of
INCREMENTAL DENTAL CARE
for
PRE-SCHOOL CHILDREN

THE WATERLOO TIME,
COST AND MANPOWER
STUDY OF
INCREMENTAL
DENTAL CARE FOR
PRE-SCHOOL CHILDREN

* * * * *

D.W. Lewis

S.C. Magid

M.E. Jarrett

August, 1975

* * *

This study was supported by Demonstration
Model Grant DM22 of the Ontario Ministry of Health

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THE WATERLOO TIME, COST AND MANPOWER STUDY OF INCREMENTAL
DENTAL CARE FOR PRE-SCHOOL CHILDREN

ACKNOWLEDGEMENTS

Credit for this study belongs to Dr. M.E. Jarrett, Dental Director of the Waterloo (Ontario) Regional Health Unit, who perceived its need, helped in its design and arranged its funding. "Monty" Jarrett then administered the program for nearly four years and died just two months prior to its completion. In a speech describing this project to the Ontario Society of Public Health Dentists in June 1971, Dr. Jarrett indicated prophetically that since no others seemed to be undertaking this necessary project "...I decided to give it a try and make it my 'swan song' in the Dental Public Health field". This report and the future use of the data in it are a tribute to his vision and effort.

This study was a huge undertaking and those who deserve mention are numerous. As in any such listing, not every one who deserves recognition can be mentioned; nevertheless, a partial list follows:

1. The participating parents and children of the Regional Municipality of Waterloo;
2. The Waterloo Regional Board of Health, its Medical Officers of Health and its Business Administrator;
3. Miss Linda Stumpf, the project secretary throughout, and the rest of the Health Unit dental staff;
4. The dentists of the Waterloo-Wellington Dental Society and their staff;
5. The project's consultant group from McMaster University's Department of Clinical Epidemiology and Biostatistics (G. Anderson, D. Sackett and A. Olynich);



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6. Mr. R. Kazlauskas of the Biometrics Section of the Division of Clinical Sciences, Faculty of Dentistry, University of Toronto;
7. Ms. S. Magid the project's research associate whose contribution at the end of the study enabled this report to be completed;
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9. Otherwise, this project was supported in full by Demonstration Model Grant number DM 22 of the Ontario Ministry of Health.

D.W. Lewis
Project Co-investigator
August 1975

SUMMARY

The Waterloo Time, Cost and Manpower Study of Incremental Dental Care for Pre-School Children was designed to demonstrate the feasibility of providing free dental care to pre-school children using private practice facilities, and to collect information which could assist in the development of such a plan on a province-wide basis.

Complete dental care was provided to two samples of 1,000 and 500 randomly selected Waterloo Region children and preventive dental care was provided to one similar sample of 500, initially at age three and continuing through age five. Care was provided by private practitioners, with the Waterloo Regional Health Unit administering the program and also providing some diagnostic and preventive care. All services provided under the plan were free of charge to the parents of participating children. The Health Unit and private dentists recorded dental services provided to project children on a patient record form which was used both as a bill for services and a source document for data on dental treatment provided under the plan and on the time and costs of providing this treatment.

Dental treatment needs of pre-school children (aged three to five) were found to be uneven from year to year. A large proportion of the children in each group and year required no fillings or extractions. The mean number of appointments per year ranged from 1.3 to 1.6 for children receiving diagnostic and preventive care only and from 3.0 to 3.9 for children also receiving restorative treatment. The mean cost per year ranged from \$13 to \$18 for children receiving diagnostic and preventive care only and from \$55 to \$64 for children also receiving restorative treatment.

Very high rates of both patient utilization and dentist participation were obtained. There were marked differences in the nature and amount of dental care provided to children of the same age. This was considered to be a product of three factors: (1) differing levels of dental disease attack; (2) differing patterns of participation in the dental care program; and (3) differing practices among dentists. Not all participating dentists routinely provided all diagnostic and preventive services with the frequency permitted under the plan nor did all dentists charge the maximum allowable fee for each item of service rendered. The study showed that it is feasible for a regional governmental agency to administer a private practice children's denticare scheme.

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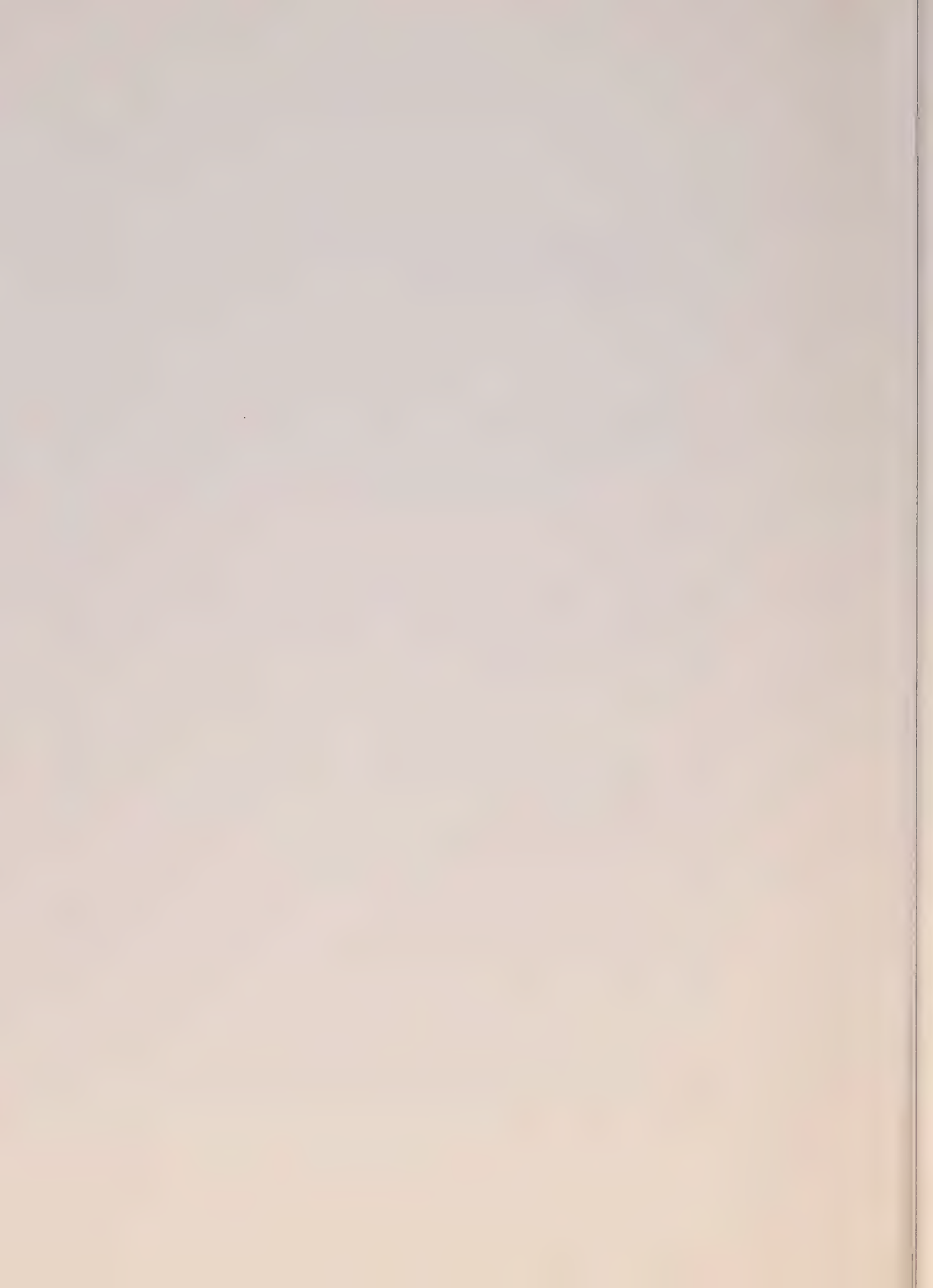


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1. INTRODUCTION

1.1 Information and Dental Care Program Planning

Dental disease, such as dental decay or gum infections, is characterized by its high attack at most ages and by its subsequent lack of self-repair. The present arrangement for providing dental care services in Ontario (entrepreneurial, solo, private practice on a fee-for-service basis) seems to satisfy current effective demands for dental care, although accessibility to care in some regions and for some economic groups is clearly deficient. However, the present system does not appear to have resulted in a population with levels of dental care equivalent to places where the delivery of care is distinctly different.¹

In Ontario the gap between treatment received and needed is wide. Overall demand for dental care is not high and is unevenly distributed, economically and geographically, within the population. The provision of dental care services is affected by the interaction of a complex mix of factors such as professional and public attitudes, the effect of dental preventive measures, the use of dental auxiliaries, the method of organizing private practice and the cost of care.

The re-organization of this complex system to provide care systematically and equitably to children with little or no out-of-pocket expense to parents has begun in several provinces in Canada, notably Saskatchewan,

¹ Children in Prince Edward Island, New Zealand and parts of the Scandinavian countries where dental care is provided in clinics associated with schools tend to use these services more readily.

Prince Edward Island, Quebec and Nova Scotia. And planning for such programs is well underway in others -- Ontario and British Columbia, for example.

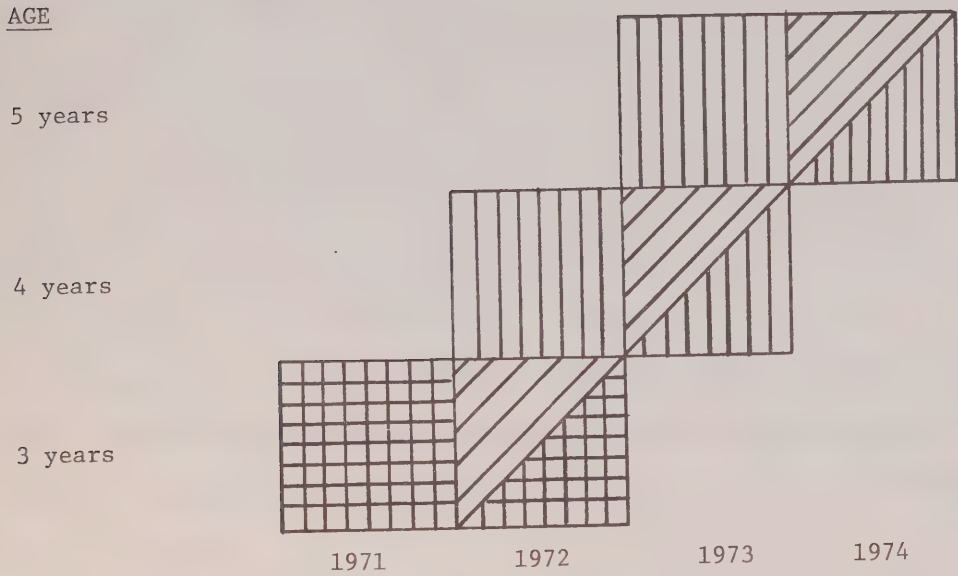
Rational planning for health care requires information -- information on the numbers of children who might be expected to use a dental care plan and their treatment needs in terms of services, costs and professional time. Such information is scarce both in Ontario and elsewhere in North America.

The present study was developed in order to provide some of this needed information on the utilization, service requirements and cost of dental care for children initially at three years of age and subsequently when they reach ages four and five. Most of the care was rendered by private dental practitioners in the region, with administration of the plan and some diagnostic and preventive services being provided by the dental staff of the Waterloo Regional Health Unit.

This method of organizing dental care in a step-wise fashion starting with young children who receive complete initial care and subsequent annual maintenance care, and then adding another initial care group each year as resources permit (see Figure 1), is popular. It has been endorsed by a number of bodies in recent years (Hall Royal Commission, 1964; Canadian Dental Association, June 1968; Ontario Dental Association 1969, 1974; Committee on Health Care Delivery Systems, Ontario Council of Health, June 1970). The Canadian Dental Association's plan (1968) included estimates of the initial and maintenance dental care needs of Canadian children.

FIGURE 1

WATERLOO CHILDREN'S INCREMENTAL DENTAL CARE PROJECT TIMETABLE



CODE

Initial
Care



Maintenance
Care



Preventive
Care



Based on these estimates, plus anticipated utilization rates and projected population and dental manpower figures, actual estimates of the cost and time requirements in terms of dentists and dental manpower hours for a national children's incremental dental health plan were derived.

Presumably because of concern over the lack of reliable information on the dental health status of children, and other assumptions (such as utilization rates) which had to be made, the Canadian Dental Association recommended that further studies be carried out to provide the essential data. The following comment taken from page 240 of the Canadian Dental Association Report indicates the degree of concern and lends support to the contention implicit in the development of this project in 1970, that further studies are needed prior to embarking on a large scale program:

"It must be emphasized again that these figures are only crude approximations. They have had to be compiled by building assumption upon assumption, a change in any one of which would greatly affect cost and manpower estimates. They are, however, believed to be the most accurate estimates possible in the current circumstances."

1.2 Background of the Study

This project arose in response to the need to provide information required prior to implementation of government-sponsored, province-wide children's denticare plans, especially those involving, mainly, fee-for-service private dentists. Dr. M.E. Jarrett, Dental Director of the (then) Waterloo County Health Unit, recognized the need for such a study in Ontario and began planning. In co-operation with Dr. D.W. Lewis of the Faculty of Dentistry, University of Toronto, a preliminary research proposal was developed and presented to the Waterloo County Board of Health

in early September 1970. The Board's endorsement of the scheme and the encouragement of McMaster University's Department of Clinical Epidemiology and Biostatistics (particularly Drs. D. Sackett and G. Anderson) and Drs. R.E. Feasby and K. Ryan, dental consultants of the Ontario Ministry of Health, led to the development of a grant application under the Ontario Ministry of Health Demonstration Model grant program to conduct a combined public health and private practice incremental dental care program for the pre-school children of Waterloo County.

Subsequently, after applying for support and meeting with a governmental grant review committee, an award to undertake the study of \$240,000 over four years was approved, subject to annual approval of progress each year. (The actual total expended under this project to August 31, 1975 was about \$213,000.) Project funding which began January 1, 1971 was followed by three months of preparatory activity to hire staff, organize the study's administration, arrange for sampling and printing of forms, and elicit the cooperation of private dentists so that the program could begin on April 1, 1971.

1.3 The Initial Study Design

The proposed study involved a complementary combination of public health personnel and private practitioners to provide incremental dental care. Specifically, the basic study design called for the provision of incremental dental care (see Figure 1) starting with initial care (including screening examination, counselling and demonstration of good preventive dental health habits, topical fluoride application, two bitewing radiographs, and all necessary fillings and extractions) to a random

sample of 1,000 Waterloo County three-year-olds. Maintenance care for this group was to be provided at four and five years of age. A similar care group of 500 three-year-olds was to be started in the second year of the study with maintenance care being provided for this second group when they too reached four and five years of age. Another group of 500, also starting in the second year of the study, was to receive diagnostic and preventive treatment only through the plan at ages of three, four and five. All dental services were to be free to the parents of participants except that treatment required in addition to the basic care outlined above was subject to review by the program's dental administrator and, at times, the Committee appointed by the Waterloo-Wellington Dental Society to act as an advisory body.

The program was to be administered by Health Unit staff. Appropriate personnel from the Health Unit would contact the parents of children selected to participate in the program. Initial patient screening and dental health counselling would normally be carried out at the Health Unit although parents would be permitted to take their children directly to private dentists if they so requested. Children seen at the Health Unit who had no apparent defects would receive bitewing radiographs and topical fluoride applications and be placed on the Health Unit recall list. Those with defects would be referred to private dentists for bitewing radiographs and all other necessary treatment. Following treatment these children would be placed on the private dentist's recall list. Parents could take their children to the dentist of their choice. A list of participating dentists was to be maintained for parents to choose from if they had no

family dentist.

All groups were to be followed up after they entered school at the routine school examinations where the examining dental hygienists would be "blind" as to whether children participated in the project, or not. This subsequent analysis was to identify differences in dental health among children belonging to the different study groups and between those children who participated in the project and those who did not (see Appendix I).

1.4 Objectives of the Study

This study was designed to provide the following information:

- I Participation rates of general practitioners (dental) in the study area.
- II Utilization rates of the three, four and five year age groups in the study.
- III Initial dental care requirements of three-year-old children and their maintenance care requirements at four and five years of age.
- IV Estimates of the time required for general practitioners to provide this care.
- V Cost estimates for the provision of this care.
- VI Essential baseline administrative and operational data to test the feasibility of a similar incremental dental care plan or program throughout the province.

Additionally it was felt that the administrative experience gained during the conduct of the study would provide helpful information to dental care planners and administrators.

2. THE STUDY SETTING

2.1 Introduction

Every geographic area within a province or country has some social, economic and physical features similar to those of other areas, as well as its own unique features. In a number of ways the Regional Municipality of Waterloo is not typical of Ontario, although only a few of these differences are thought to influence dental health and dental care. Because the applicability of the results of this dental study to the rest of the province and elsewhere is anticipated, it is essential to describe this Region in some detail. This will be done in four parts: geographic, economic, and demographic characteristics; fluoridated water; dentist supply; children's dental health status.

2.2 Geographic, Economic and Demographic Characteristics

The Regional Municipality of Waterloo is located in Southern Ontario about 60 miles west of Metropolitan Toronto (Figure 2). It was re-designated from the status of a county (Waterloo) to that of a regional municipality in 1972. The city of Galt and the adjoining towns of Hespeler and Preston became the city of Cambridge in 1973. The map of the Regional Municipality shows the relationship of the three cities -- Cambridge, Kitchener and Waterloo, to the surrounding, less urban villages, towns and townships (Figure 3). In Table 1, selected indicators from the 1961, 1966 and 1971 federal censuses for Waterloo County (Region) and Ontario are presented. The main features of Waterloo relative to Ontario are its relatively greater urban population and German ethnicity.

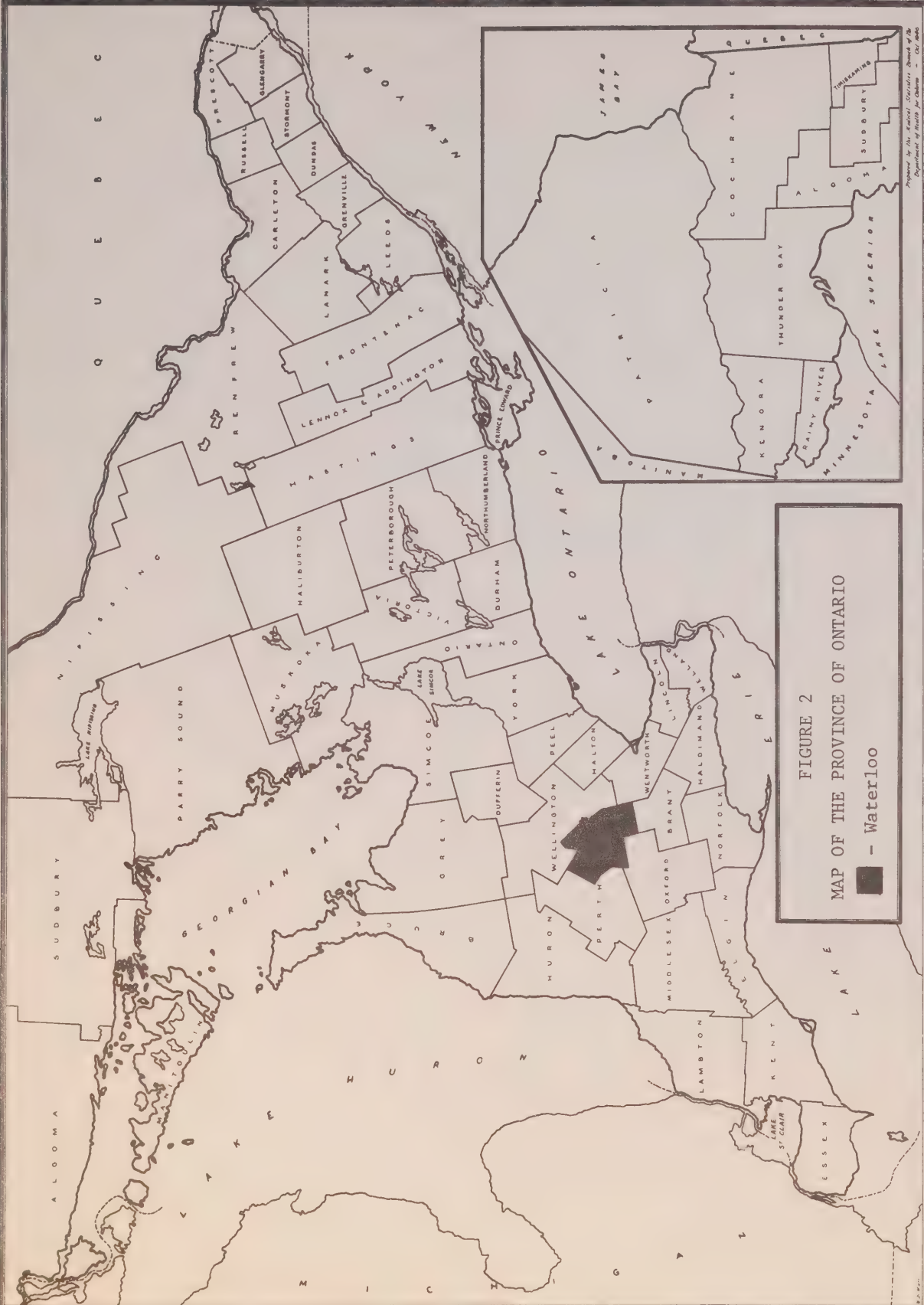


FIGURE 2
MAP OF THE PROVINCE OF ONTARIO
— Waterloo

FIGURE 3

MAP OF THE REGIONAL MUNICIPALITY OF WATERLOO



TABLE 1

SELECTED CHARACTERISTICS OF THE POPULATION OF THE PROVINCE OF ONTARIO AND WATERLOO COUNTY
(REGION) -- 1961, 1966, 1971 (SOURCE: STATISTICS CANADA)

Characteristics	1961		1966		1971	
	Ontario	Waterloo	Ontario	Waterloo	Ontario	Waterloo
1. Total Population	6,236,092	176,754	6,960,870	216,728	7,703,105	254,035
2. % Urban	77.4	83.7	80.3	86.2	82.4	87.7
3. % Rural Non-farm	14.5	9.8	12.7	8.5	12.9	8.6
4. % Farm	8.1	6.5	6.9	5.3	4.7	3.7
5. % 0-4 Years	11.9	11.9	10.7	11.4	8.3	9.3
6. % 5-9 Years	10.8	11.1	11.1	10.9	10.2	10.3
7. % 10-14 Years	9.5	9.4	9.9	9.8	10.2	9.8
8. % 15-19 Years	7.0	7.2	8.6	8.9	9.3	9.3
9. Mean No. Children/Family	1.6	1.6	-	-	1.6	1.6
10. Average Earnings - Male Wage Earners	\$3,984	\$3,805	-	-	\$7,213*	**
11. Average Earnings - Female Wage Earners	\$2,119	\$1,906	-	-	\$3,328*	**
12. Ethnic Groups -						
% British Isles	60.0	40.0	-	-	59.4	49.4
% French	10.4	3.9	-	-	9.6	4.2
% German	6.4	39.4	-	-	6.2	29.7
% Italian	4.4	1.1	-	-	6.0	1.3

* The large rise in average earnings between 1961 and 1971 can be attributed in part to a change in the definition of "wage earner" for the 1971 census resulting in the inclusion of more high income persons in that category.

** Not available from the federal census at the time of completion of this report.

Further insights into the character of Waterloo can be made by referring to two recent reports and these will be quoted from briefly in the remainder of this section:

- 1) Strategy for Growth -- Waterloo-South Wellington Area Study -- Final Report -- Part 1, June, 1972, page 1:

"The Waterloo County Area was settled in the 19th century by Mennonite farmers from Pennsylvania, who were of German ethnic origin and who settled in the Kitchener-Waterloo area, and Scottish immigrants who settled principally in the area now known as Dumfries Township and the City of Galt. Later, immigrants from Germany, primarily craftsmen and skilled machinists, settled in the Kitchener-Waterloo area. These early settlers together laid the foundation for the county's subsequent prosperous agricultural and manufacturing economic base.

The average annual population growth of the area has been significantly higher than the Canadian and Ontario averages. A large part of this relatively high population growth rate has been due to the importance of manufacturing industry in the Study Area."

- 2) Waterloo Area -- Local Government Review Report -- Fyfe Report, February, 1970, page 15:

"Waterloo County is, by the standards of southern Ontario, a relatively compact area, of some five hundred square miles (more than twice the size of Metropolitan Toronto). In terms of population the geographic county is the fifth largest out of thirty-eight. The municipal county (i.e. excluding the Cities) is twelfth largest.

The pattern of settlement of this Area is unique among Ontario counties. The County of Waterloo, geographically, embraces two distinctly separate and very substantial urban complexes surrounded by a broad expanse of first-class farming area. In this rural area are a number of small urban centres.

"There are other counties that have much larger urban populations: what is significant about the Waterloo Area and of singular interest to this Review is not only the large number of Cities and Towns of substantial size within a single county, but also that these are grouped in two adjoining urban clusters or complexes. In one complex, the Cities and a Village, Kitchener-Waterloo-Bridgeport, are contiguous to one another. In the other, two Towns, Preston and Hespeler, and a City, Galt, are contiguous save for Highway 401 separating Hespeler from Galt-Preston. In brief, the Area could be said to comprise, in its major urban parts, a 'multiple city' structural arrangement. It is not a metropolitan area in the usual sense of one large central city surrounded by suburbs, nor are the populations of the size normally envisaged in the term 'metropolitan'."

p.20

"The two urban complexes are distinctive in their labour force characteristics as well. In general Waterloo has a preponderance of so-called white collar workers, having the highest proportions of the municipalities concerned in managerial, professional-technical, clerical and sales work. Dominant in the 'blue collar' categories is Hespeler with the highest proportion of craftsmen and labour designations. Galt and Preston have much in common in their labour force characteristics, as do Kitchener and Waterloo in theirs.

In Galt-Preston, about forty-three percent of the labour force is engaged as craftsmen, while in Kitchener-Waterloo the figure is thirty-five percent. Again, Galt-Preston each have thirteen percent of their labour force in clerical work and about seven percent in sales, while Kitchener-Waterloo have seventeen percent and eight percent in these categories, respectively. Only in professional and technical pursuits are similar proportions engaged of Galt's and Kitchener's labour forces. Preston's proportions of labour force devoted to these activities are lower and Waterloo's higher.

The distinctive ethnic pattern of the two urban cores continues from the early days. In the three municipalities Kitchener-Waterloo-Bridgeport those of German origin constitute the largest ethnic group, about forty-five percent of the population of that area, while in the Galt-Preston-Hespeler complex the proportion of the population of Scottish, Irish and English extraction is approximately sixty-five percent."

2.3 Fluoridated Water

The City of Waterloo had fluoride added to its water supply in mid-1967. The only other water in the Region with appreciable fluoride content is found in the Village of Wellesley (not, though, outside the Village in the whole Township of Wellesley).

2.4 Dentist Supply

Table 2 compares the dentist supply of Waterloo Region with that of the entire province of Ontario in the years that the incremental dental care program was being implemented. The population-to-dentist ratio in Waterloo was very similar to that in the province as a whole. Data from unpublished surveys conducted by Dr. D.W. Lewis in 1968, 1973 and 1974 reveal that the mean age of dentists in Waterloo Region was also close to the provincial average although Waterloo dentists tended to be slightly younger.²

As far as dental public health programs are concerned, the Region of Waterloo has enjoyed an active dental public health preventive and education program staffed by a dentist, dental hygienists, preventive dental assistants and dental assistants for many years.

2.5 Children's Dental Health Status

Provincial survey data from 1969 to 1974 comparing the dental health of five-year-old children in Waterloo and the entire province of Ontario are shown in Table 3. Data for older children are available and generally

² The mean age of dentists in Waterloo Region was: 1968, 44.6 years; 1973, 40.9 years; 1974, 39.4 years. In the province of Ontario the mean age of dentists was: 1968, 45.6 years; 1973, 42.9 years; 1974, 41.2 years.

TABLE 2

DENTIST SUPPLY IN THE PROVINCE OF ONTARIO AND WATERLOO REGION*

Year	Assessed Population		Number of Dentists		Population per Dentist	
	Ontario	Waterloo	Ontario	Waterloo	Ontario	Waterloo
1971	7,235,929	250,287	3,209	105	2,254	2,383
1972	7,833,900	257,300	3,270	113	2,398	2,276
1973	7,674,849	263,407	3,388	119	2,265	2,213
1974	8,094,000	276,337	3,534	119	2,290	2,322

* Statistics were obtained from the Proceedings of the Royal College of Dental Surgeons of Ontario - 1971, 1972, 1973, 1974

TABLE 3

DENTAL HEALTH STATUS OF FIVE-YEAR-OLD CHILDREN IN THE PROVINCE OF ONTARIO AND WATERLOO REGION

Average Number of Teeth	1969-1970*		1970-1971*		1971-1972		1973-1974	
	Ontario (N=8,411)	Waterloo (N=145)	Ontario (N=8474)	Waterloo (N=501)	Ontario (N=59,843)	Waterloo (N=767)	Ontario (N=43,241)	Waterloo (N=833)
Lost	0.17	0.19	0.18	0.20	0.22	0.15	0.14	0.23
To Be Lost	0.14	0.05	0.14	0.09	0.17	0.10	0.11	0.13
Decayed	1.11	1.31	1.42	1.75	1.38	1.43	1.14	1.33
Filled	0.95	2.06	0.88	1.60	0.87	1.37	0.92	1.36
def&DMF Teeth	2.37	3.63	2.64	3.66	2.64	3.06	2.32	3.06
Percentage With No Defects or Complete Caries Care	58	56	54	43	66	59	63	60
Percentage of Decayed Teeth Requiring Treatment (fillings or extractions)	52.7	37.5	59.1	50.3	59.1	50.0	53.9	47.7

* In these surveys only the first, primary teeth were scored for decay since the permanent, secondary teeth just start eruption at ages five and six.

show similar trends. No detailed Waterloo data are available for children under five years of age.

The Waterloo five-year-olds have, on the average, higher numbers of teeth attacked by decay (def + D.M.F.) than their Ontario counterparts. This difference may be due, in part, to the beneficial influence of fluoridated water -- the province of Ontario as a whole has relatively more children exposed to water fluorides than does the Region of Waterloo.³ Although the absolute average number of teeth requiring treatment (i.e. the sum of the average number of 'to be lost' and 'decayed' teeth) is higher in Waterloo, the percentage of these teeth relative to the total number of teeth attacked by decay is lower than that in the entire province. This can be seen in the last line of Table 3.

In summary then, while the children of the Waterloo Region display higher amounts of decay relative to the children of Ontario, they have achieved relatively more treatment at age five (and other ages). Their higher treatment levels are, of course, consistent with the Region's good dentist supply relative to other counties and its active dental public health program which encourages children to seek care.

³ This results from the fact that Metropolitan Toronto, an area with a population of over 2,000,000 people, has fluoridated water.

3. METHOD OF OPERATION

3.1 Sampling

The study design called for the selection of a sample of 1,000 three-year-olds to participate in the first year of the program (1971), and the selection of two samples of 500 three-year-olds to participate in the second year (1972). Each group was to continue in the program for a total of three years.

The 1971 sample (Group I) was selected from a list of two and three-year-olds compiled on the basis of the 1970 Provincial Assessment Role for Waterloo County. Similarly, the 1972 samples (Group II and Group III) were selected from a list based on the 1971 Assessment Role. At the request of provincial authorities, I.B.M. provided study personnel with lists of all children resident in Waterloo County who were born in 1967 or 1968 (for the 1971 sample) and 1968 or 1969 (for the 1972 samples). The lists included names, addresses, and years of birth but not birthdates. Precise information as to birthdates had to be obtained from Health Unit records or by direct contact with families involved (usually by telephone).

The 1971 sample was randomly selected from the list of all those children still three years old as of April 1, 1971. The 1972 sample was randomly selected from the list of all those children born between August 1968 and September 1969.⁴ The County was divided into fifteen areas and

⁴ There was some overlap between the two samples. Children born between August and December, 1968, could have been included in both samples.

children were selected from each area in proportion to the number of three-year-olds residing in that area (see Table 4).

Statistics as to the number of three-year-olds in each of the fifteen areas were provided by County authorities. Originally it was planned to begin with a full sample of 1,000 children in 1971 and a list of 500 alternates was available to replace any children who had been selected for the sample but who could not be contacted or whose parents did not agree to have them participate in the study. After discussion with consultants Drs. Sackett and Anderson from McMaster University it was decided to proceed with those children initially selected for inclusion in the sample only. This would permit the researchers to ascertain what proportion of the parents of a sample of children selected to take part in a free incremental dental care program could be contacted and would consent to participate, and what proportion of those who initially agreed to participate would subsequently drop out of the program.

3.2 Patient Contact and Follow-Up

Letters were sent to the parents of the children selected to participate in the study. These were accompanied by a brief outline of the project. (See Appendix A for copies of the letters and outline.) Parents were asked to complete a consent form and mail it to the Health Unit.

All participants in the first year of the study (Group I) were to receive complete dental care. Responses were initially received from the families of 850 of the 1,000 children selected for Group I. Follow-up

TABLE 4

DISTRIBUTION OF THREE-YEAR-OLD CHILDREN WITHIN
WATERLOO COUNTY (REGION) - 1970, 1971

Area	1970		1971	
	N	%	N	%
Kitchener	1,962	(42.7)	1,994	(44.0)
Waterloo	637	(13.9)	583	(12.9)
Galt	692	(15.1)	688	(15.2)
Ayr	27	(0.6)	26	(0.6)
North Dumfries	66	(1.4)	62	(1.4)
Elmira	75	(1.6)	86	(1.9)
Woolwich Township	128	(2.8)	141	(3.1)
Wellesley Village	20	(0.4)	16	(0.4)
Wellesley Township	150	(3.3)	149	(3.3)
Bridgeport	53	(1.2)	45	(1.0)
New Hamburg	52	(1.1)	64	(1.4)
Waterloo Township	146	(3.2)	127	(2.8)
Preston	289	(6.3)	316	(7.0)
Hespeler	136	(3.0)	123	(2.7)
Wilmot Township	157	(3.4)	112	(2.5)
TOTAL	4,590	(100)	4,532	(100)

revealed that of the 150 families who failed to respond, 57 had misplaced or destroyed the letter, 28 had not understood its significance, and 23 could not remember receiving it. An additional 42 families had moved without leaving a forwarding address and could not be followed up. A total of 903 consents were finally received from this group.

Response was even better in the second year of the study. This was attributed to the good publicity which the program received during its first year of operation and the corresponding increased understanding of, and familiarity with, the program on the part of parents in the region. Two samples of 500 children each were originally selected. Those selected for Group II were to receive complete dental care; those selected for Group III were to receive diagnostic and preventive care only (i.e. screening examination, bitewing radiographs, counselling and demonstration of good dental health habits, and topical fluoride application). Consents were received from the parents of all 500 children in Group II; 472 consents were obtained on behalf of children in Group III.

According to the letters sent to the parents of children selected for participation in the program, the initial examination of each child would take place at the Health Unit. Following receipt of consent forms, Health Unit personnel contacted parents by telephone (or by letter in the case of those without telephones) in order to make an appointment for an initial examination at the Unit. Those parents who expressed a desire to take their children directly to their own family dentists were permitted to do so. In all other cases appointments were made for examinations by the Health Unit

staff. Those children who were found, upon examination, to require reparative treatment, were referred to private dentists. Those children who did not require such treatment were placed on a recall list by the Health Unit.

3.3 Dentist Contact and Participation

Letters were sent to all dentists in Waterloo Region (as well as to dentists in the neighbouring county of Wellington) inviting them to participate in the incremental dental care program. The dentists were asked to complete a form indicating whether or not they would participate in the program and to mail it to the Health Unit. (See Appendix B for a copy of the letter and form.) Of 140 dentists originally contacted, 135 agreed to participate in the study. New dentists were added to the list as they moved into the area.⁵ By the end of the study (December 31, 1974) a list of 167 dentists had been compiled.

A total of 114 dentists (other than dentists from the Health Unit) actually treated patients who were participating in the program. Of the 120 dentists from Waterloo Region who expressed a willingness to take part in the study, 103 (85.8%) treated at least one child in the program. Of the 33 dentists from Wellington County who had agreed to participate in the study, only two treated any children participating in the program. Nine other dentists also saw a small number of children in the program.

5. To enable children who moved outside the Region during their time in the program to continue to participate, arrangements were made for payment to dentists other than those who had originally been approached and had consented to take part in the study. Very few families took advantage of this, however (probably they were unaware of it), and almost all participants in the program saw dentists in Waterloo Region.

Of the 103 participating dentists in Waterloo Region, 73 (70.9%) were located in Kitchener-Waterloo, 24 (23.3%) in Cambridge, 4 (3.9%) in Elmira, and 2 (1.9%) in New Hamburg.

The level of dentist participation in the program was measured in patient-years. A patient-year is defined as the treatment of one patient (from any group) for one year. For example, a dentist whose level of participation in the study is given as 30 patient-years may have treated 10 patients (from any group) for 3 years each; 7 patients for 3 years each (21 patient-years), 3 patients for 2 years each (6 patient-years), and 3 patients for 1 year each (3 patient-years); etc. Table 5 describes the level of participation of the 114 private dentists who treated patients in the program.

The eleven dentists from outside of Waterloo Region all fell into the lowest category of participation (one to nine patient-years). The highest level of participation was 196 patient-years. Four dentists participated at a level of 100 or more patient-years.

3.4 Dental Services Coverage and Allowable Fees

In the first year of the program, only one annual dental examination, one pair of bitewing radiographs, and one topical fluoride application were funded. The annual frequency of diagnostic and preventive procedures covered was changed after the first study year, 1971, to allow for common six-month recall practice. Usually, however, payment for only one pair of bitewing radiographs annually was allowed. The actual effect in terms of significantly improved dental health benefits (outcomes) of greater than

TABLE 5

LEVEL OF DENTIST PARTICIPATION

Dentist Participation (in patient-years)	Dentists Treating Patients	
	N	%
1 to 9	35	(30.7)
10 to 29	37	(32.5)
30+	42	(36.8)
TOTAL	114	(100)

once annual dental examinations and topical fluoride application for the large majority of children is not fully known, but in this study custom prevailed in the face of this uncertainty.

The program covered children in Groups I and II for a broad range of basic diagnostic, preventive, restorative and surgical services (see Table 6). These services are believed to include over 90% of the services children generally need. Full mouth radiographs and orthodontic care (except for space maintainers) were specifically excluded. Although it does not appear on the list, surgical removal of teeth in hospital under complete anaesthesia, where clearly indicated, was allowed subject to pre-authorization.

Children in Group III were eligible for "free" preventive and diagnostic services only, with other required treatment being the responsibility of the parent both for payment and dentist appointment arrangements. Much of the diagnostic and preventive care to this group (and Group II) was given by Health Unit personnel, especially in the first study year.

The maximum fees payable for the various services are listed in Table 7. As the table indicates, the initial fees payable, set according to the 1969 Ontario Dental Association Fee Guide, were changed after the first study year (1971) to conform with the 1971 Fee Guide thereafter. Participating dentists were told that their usual and customary fees should prevail except that in no case should they exceed those stated in the Fee Guide (see Table 7). No specific instructions were given about reduced fees due to time saving when two or more fillings were done at one visit although the Ontario Dental Association made suggestions about this to all Ontario dentists during the period in which the project was conducted.

TABLE 6
DENTAL SERVICES COVERED IN EACH STUDY GROUP AND YEAR

Group I Year 1 1971	Group I Years 2,3 Group II Years 1,2,3 1972-1974	Group III Years 1,2,3 1972-1974
1 Annual examination 1 Pair bitewing radiographs* 1 Annual topical fluoride**	2 Annual examinations 1 Pair bitewing radiographs* 2 Annual topical fluorides***	2 Annual examinations 1 Pair bitewing radiographs* 2 Annual topical fluorides***
All necessary fillings, stainless steel crowns and extractions Space maintenance, pulp treatment, specialist Consultation available as required		- - - - -

* Occasionally under special circumstances a second pair of bitewing radiographs was funded.

** All topical fluoride applications were to include a prior dental prophylaxis.

*** It was stressed to participating dentists that the second topical fluoride was to be done only as required by a particular child.

TABLE 7
MAXIMUM ALLOWABLE FEES FOR DENTAL SERVICES*

Service	Group I Year 1 1971	Group I Years 2,3 Group II Years 1,2,3 1972-1974	Group III Years 1,2,3 1972-1974
	\$**	\$***	\$***
Examination	4	5	5
Bitewing Radiographs	6	6	6
Topical Fluoride (and prophyl)	7	8	8
1 Surface Filling	7	8	-
2 Surface Filling	15	17	-
3 Surface Filling	16	19	-
Extraction	8	9	-
Other ****			

* Participating dentists were told that charges should be at their usual and customary fees, but, in no case more than the fees listed here.

** 1969 Ontario Dental Association Fee Guide.

*** 1971 Ontario Dental Association Fee Guide.

**** Other services such as space maintainers were paid up to the level specified in the appropriate dental fee guide.

An advisory committee was established by the executive of the Waterloo-Wellington Dental Society from its members, to act in cooperation with the program's dental administrators on all matters pertaining to the project, particularly matters for review, and to act as liaison between the private practice and Health Unit administrative sectors. (Some special services required prior authorization and therefore could be one of the areas of review.)

3.5 Record Keeping

A patient record form was developed for the purposes of the study (see Appendix C)⁶. One page of this double sheet was to be filled in and retained by the treating dentist as an office patient record, while the second, duplicate sheet was to be sent to the Health Unit where it would be processed for payment and retained in a patient file.⁷ Dentists were also asked to send one set of bitewing radiographs per patient to the Health Unit. For each child participating in the program an individual record file was maintained containing processed patient record forms, bitewing radiographs, and the parental consent form.

An alphabetically organized rotary card file was also developed for the study. Each participating child had a card in this file containing: the child's name; study identification number; telephone number; birthdate;

⁶ Patient record forms were mailed or delivered personally to all participating dentists.

⁷ In fact most dentists returned both sheets and some sent in copies of their own personal forms as well.

school (when applicable); dentist code number; residence code; and a dated record of payments made to dentists on the child's behalf.

A master list of all participating dentists giving each dentist's unique study code number, telephone number and address was maintained and updated as required.

3.6 Data Processing and Analysis

Patient record forms were checked by Health Unit personnel and copies were sent to the Biometrics Section of the Division of Clinical Sciences, Faculty of Dentistry, University of Toronto, for data processing.

An unique patient identification number was assigned to each patient who participated in the program. One record was compiled for each patient for each year he or she participated. This permitted two types of data analysis: firstly, analysis by group and year; and secondly, analysis by patient. Analysis by group and year involved the examination of differences in the type, frequency, and cost of services rendered to patients in each group over the three years of the study, and between groups in each year of the study. Analysis by patient involved the examination of the type, frequency, and cost of services rendered to each patient over the entire course of his or her participation in the study.

After being keypunched onto cards the data were subjected to a computer edit. Two problems passed undetected through the edit check. In five cases (three in Group I and two in Group II) either two different patients had the same identification number or one patient had two

different records in one year. These cases affected the analysis by group and year very slightly. They were eliminated from the analysis by patient so that while there were actually 827 patients who appeared in Group I and 495 in Group II, data is presented for only 824 patients in Group I and 493 in Group II.

The other error involved the designation of patients as Health Unit or private patients. Any patient who saw a private dentist in the course of a given year should have been considered a private patient. It appears that in a few cases patients were designated as Health Unit patients when the Health Unit sent in patient record forms early in a given year, and their designation was not changed, as it should have been, when private dentists sent in forms after seeing the patients later in the same year.

4. PROBLEMS IN OPERATION

4.1 Introduction

One of the stated objectives of the incremental dental care project was to provide information which could assist in the development of a children's dental care plan on a province-wide basis. Information and experience obtained over the course of the Waterloo project could also assist in the development of similar demonstration projects in other areas of the province. In order that others may profit fully from the experience of the Waterloo project, problems encountered in the operation and administration of the project are described in this section.

4.2 Method of Data Collection

Dentists were required to complete a patient record form and send it in to the Health Unit in order to receive payment for services rendered under the dental care plan. It appears that many of the participating dentists regarded the form simply as a bill for services and, as a result, they did not fill out the sections of the form that were not relevant for billing purposes carefully. For example, although specific instructions were given on the form, the coding of the tooth diagrams was not properly done, rendering it impossible to determine the initial dental health status of patients entering the program. Similarly, questions regarding the need for additional treatment and acceptance of proposed treatment were unanswered in many cases. Although the administrators of the incremental dental care plan could have insisted that the patient record forms be fully and accurately completed prior to payment, this was not done.

Additional problems arise from the fact that, since services rendered were recorded for billing purposes only, there is no record of any services that were not billed under the plan. Thus there is no record of treatment beyond basic diagnostic and preventive care for patients in Group III since such treatment was not covered under the plan. There were also instances where the costs of some dental treatments were paid by private insurance plans or by the government-operated Ontario Health Insurance Plan. These treatments may or may not have been recorded on the patient record form depending upon whether all or only part of the costs involved were paid by the private or public insurance plan.⁸

4.3 Patient Record Form

Information on individual patients, the treatment they received, and the cost of treatment was collected on the patient record form developed for the dental care project (see Appendix C). This form was used both as a bill for services and as a source document for key-punching of patient data. While the form generally served the purposes for which it was designed, and the failure of dentists to fill in certain sections appears to be the result of factors other than problems with the form (see Section 4.2), some problems did arise with the form itself.

⁸ The total cost of dental services rendered to children in the program should have included expenditures made by private and public insurance plans on behalf of children in the program, however, no data on these expenditures were available. Fortunately, they are believed to be relatively small.

The patient record form was a single sheet with one attached duplicate sheet. Although participating dentists were asked to return one sheet by letter⁹ and had an opportunity to discuss this with Dr. Jarrett during his visits to their offices, there was confusion as to whether one, two or either of the two patient record form sheets should be returned. Most dentists returned both sheets. Since the intended single returned sheet would have had to serve both as a record for payment purposes and for the key-punching of the data it contained, it would have been better if the form had consisted of an original and two copies -- the original serving as the Health Unit record, one copy for the dentist's files and the other for data processing.

Separate, clear instructions on the disposition of each copy as well as on the requirements for satisfactory completion of the form would also have been useful. (Parts of the form were not completed satisfactorily, for example, the coding of the tooth diagrams, even though specific instructions were given on the form.)

Problems also arose from the content and design of the form. The section on "Parent's Occupation, Ethnic Background and Years in Country" was added to the original form after the first year of the study. Although the addition of this section was mentioned in a letter to participating

⁹ Early in 1971 a letter to all participating dentists indicated: "...We are asking for 1 copy of the bitewings to be sent with your account, along with one copy of the duplicate chart which will be furnished for each child..."

dentists, no explanation was given of how to collect this information or of the use to which it would be put.¹⁰ Many dentists did not fill in this section and even when they did there were difficulties in interpreting the data.

Since space in the "Itemized Services Rendered" section was lacking for cases requiring extensive treatment, more than one form had to be used for such cases. This increased the possibility of coding or key-punching errors since data from at least two sheets had to be combined into one record for persons with extensive work in one treatment series and for persons with more than one treatment series in a single year. Space was not provided in this section for dentists who did only tooth cleaning and not topical fluoride applications (including a dental prophylaxis) for their patients.

Total time of treatment was recorded in fifteen minute time blocks. Although this method largely remains untested, to ask for more precise stop-watch times would have been unreasonable. During the first study year it was discovered that many patients required "More than 105" minutes of care annually, and three new, higher time categories were added to the form.

10 It is debatable whether standardization in the determination of these social variables is possible in numerous busy offices even with greater explanation than was given.

11 Unfortunately, no corresponding change was made in the coding of this variable for computer analysis and as a result the highest time category that could be coded remained "More than 105" minutes throughout the study.

Questions 2 and 3 at the bottom of the form, concerning the need for further treatment and the acceptance of proposed (purposed, sic) basic dental care treatments, respectively, were initially intended to elucidate why some patients required further treatment after treatment provided under the incremental dental care plan was completed, and why certain types of treatment that could be provided under the plan were not accepted by the parents of participating patients. While responses to questions 2 and 3 indicate that a small percentage of patients in each group and year apparently required further treatment and/or rejected suggested treatment, the reasons were not specified. Moreover, it is likely that participating dentists interpreted these questions in different ways. Further explanation was clearly required along with examples or suggested response categories. Responses to question 4, concerning placement on the dentists' recall lists, indicated that, on the average, 97% of the patients seen in each year were to be recalled, however space for an explanation of the reasons for non-placement on the list was not provided.

4.4 Radiographs

As a possible quality control mechanism and to ensure public accountability one copy of the two bitewing radiographs was requested with each account¹². This request was not strictly enforced, possibly due to the use of single rather than double films by many dentists who were understandably loathe to give up their only set of radiographs. Some dentists

¹² Radiographs which are normally taken at the beginning of a treatment series would of course, only reflect previous treatment done; however, they would also permit estimation of treatment actively needed involving cavities between the posterior teeth.

did provide one or more sets of radiographs; some were available because they had been taken at the Health Unit; and many were returned as a result of a mailed request at the end of the study. Copies of bitewing radiographs were obtained for 614 (74.2%) of the patients in Group I, 303 (61.2%) of the patients in Group II, and 283 (62.5%) of the patients in Group III. Unfortunately, the radiographs obtained were not taken at the same stage in the study for all patients. Bitewing radiographs taken at the beginning of the study could have been useful in establishing the dental health status and treatment needs of children entering the program. Radiographs taken at specified intervals throughout the program or at the end of the program and sent in to the Health Unit could have been useful in monitoring the treatment received by patients under the plan. Radiographs taken at all different stages in the program, however, provided no data that could be used in the present report.

4.5 Patient Contacting Procedures

Originally it was planned to obtain full samples of 1,000 children in 1971 and another 1,000 (two groups of 500) in 1972, and lists of alternates were available to replace any children who had been selected for the program but who could not be contacted or whose parents did not wish to have them participate. It was decided, after consultation, not to replace non-participants with alternates in order to ascertain what proportion of the original sample could be contacted and would agree to participate. The intention was to obtain figures which could be used to predict the patient utilization rate of a free dental care plan.

The patient utilization rate was very high. The proportion of children selected for participation in the study who appeared for treatment at least once was 88.8% (see Section 5.1). The high rate of patient participation, however, was due only in part to the services offered. It was also due to the very active role played by Health Unit staff in ensuring that the largest possible number of children eligible for care under the plan actually received it.

Parents who did not respond to the letter requesting their consent to their child's participation in the incremental dental care program were contacted by Health Unit staff to determine the explanation for their non-response and to clear up any misunderstandings which may have led them to withhold consent.¹³ Telephone calls were made to set up initial appointments for each child. When it appeared that a child who was participating in the program was not receiving regular dental care, attempts were made to determine the reasons, provide further explanations of the services available under the plan, and ensure that the child received the care to which he or she was entitled. These initiatives taken by the staff of the Health Unit clearly contributed to the high patient utilization rate. A children's dental care plan that did not provide the considerable resources necessary to draw children into a dental care program and monitor their participation in the program would not be expected to attain a patient utilization rate as high as that which was attained in the Waterloo study. On the other hand, a majority of the parents involved apparently responded to the original letter without extra encouragement.

¹³ Contacts were generally made by telephone. Parents who could not be reached by telephone were contacted by letter.

5. CHARACTERISTICS OF THE SAMPLE POPULATION

5.1 Patient Participation

The Waterloo incremental dental care study was designed to simulate a government sponsored children's denticare plan and to provide information which could assist in the development of such a plan on a province-wide basis. Two thousand pre-school children from Waterloo County were randomly selected for participation in the study. Sampling methodology and procedures for patient contact and follow-up were discussed above (see Sections 3.1 and 3.2).

The participation rate of children selected for inclusion in the study was very high. Table 8 describes the patterns of patient participation.

Of the 1,000 children originally selected for Group I, 827 (82.7%) appeared at least once during the course of the study. Of these, 686 (83.0%) appeared during each of the three years, 107 (12.9%) appeared in two years of the study, and 34 (4.1%) appeared in only one year. In Group II, 495 (99.0%) of the original 500 children selected appeared at some point in the study. Of these, 342 (69.1%) appeared in all three years, 115 (23.2%) appeared in two years and 38 (7.7%) appeared in one year. In Group III, 453 (90.6%) of the 500 children selected appeared at least once. Of these, 290 (64.0%) appeared in all three years of the study, 113 (24.9%) appeared in two years, and 50 (11.0%) appeared in only one year.

Looking at the total sample, of the 2,000 children originally selected to participate in the free dental care program, 1775 (88.8%) appeared for

TABLE 8
PATTERNS OF PATIENT PARTICIPATION

Patient Participation	Group I		Group II		Group III		TOTAL	
	N	%	N	%	N	%	N	%
Year 1 Only	27	(3.3)	22	(4.4)	27	(6.0)	76	(4.3)
Year 2 Only	2	(0.2)	8	(1.6)	6	(1.3)	16	(0.9)
Year 3 Only	5	(0.6)	8	(1.6)	17	(3.8)	30	(1.7)
Years 1 and 2	34	(4.1)	26	(5.3)	35	(7.7)	95	(5.4)
Years 1 and 3	62	(7.5)	69	(13.9)	58	(12.8)	189	(10.6)
Years 2 and 3	11	(1.3)	20	(4.0)	20	(4.4)	51	(2.9)
Years 1, 2 and 3	686	(83.0)	342	(69.1)	290	(64.0)	1,318	(74.3)
TOTAL	827	(100)	495	(100)	453	(100)	1,775	(100)

treatment at least once during the course of the program. Approximately two-thirds (N=1318) of those originally selected -- or three-quarters of those who participated appeared consistently in each of the three years of the study. The number of patients appearing in each group in each year of the study is described in Table 9.

5.2 Area of Residence

In 1971 and 1972, when the study samples were selected, Waterloo County was divided into 15 areas. The size of the samples to be drawn from each area was calculated as a proportion of the number of three-year-olds. (See Table 4 for the distribution of three-year-olds within Waterloo County in 1971 and 1972.) Table 10 describes the area of residence of the children who participated in the study, at the time of their first appointment under the incremental dental care plan.

5.3 Sex

Table 11 describes the sex distribution of the patients in each of the sample groups. The study findings were all analyzed separately for boys and girls, however, no large or consistent sex differences appeared. Data are, therefore, presented for the total sample and are not broken down according to sex.

5.4 Age

The Waterloo incremental dental care program was designed to provide complete initial dental care at age three and complete maintenance care at ages four and five to two randomly selected groups of children (Group I and Group II). A third group (Group III) was to receive diagnostic and

TABLE 9

NUMBER OF PATIENTS APPEARING IN
EACH GROUP AND YEAR

Group	Y e a r		
	Year 1	Year 2	Year 3
Group I	809	733	765
Group II	459	398	439
Group III	410	351	385

TABLE 10

DISTRIBUTION OF PATIENTS BY AREA

Area	Group I		Group II		Group III		TOTAL	
	N	%	N	%	N	%	N	%
Kitchener	370	(44.9)	222	(45.0)	219	(48.3)	811	(45.8)
Waterloo	115	(14.0)	61	(12.4)	53	(11.7)	229	(12.9)
Galt	105	(12.7)	86	(17.4)	65	(14.3)	256	(14.5)
Ayr	4	(0.5)	3	(0.6)	3	(0.7)	10	(0.6)
North Dumfries	12	(1.5)	8	(1.6)	7	(1.5)	27	(1.5)
Elmira	20	(2.4)	9	(1.8)	12	(2.6)	41	(2.3)
Woolwich Township	9	(1.1)	12	(2.4)	13	(2.9)	34	(1.9)
Wellesley Village	8	(1.0)	2	(0.4)	2	(0.4)	12	(0.7)
Wellesley Township	18	(2.2)	10	(2.0)	12	(2.6)	40	(2.3)
Bridgeport	14	(1.7)	5	(1.0)	4	(0.9)	23	(1.3)
New Hamburg	9	(1.1)	9	(1.8)	7	(1.5)	25	(1.4)
Waterloo Township	31	(3.8)	12	(2.4)	14	(3.1)	57	(3.2)
Preston	53	(6.4)	28	(5.7)	27	(6.0)	108	(6.1)
Hespeler	28	(3.4)	14	(2.8)	7	(1.5)	49	(2.8)
Wilmot Township	28	(3.4)	12	(2.4)	8	(1.8)	48	(2.7)
TOTAL	824	(100)	493	(100)	453	(100)	1,770	(100)

TABLE 11

DISTRIBUTION OF PATIENTS BY SEX

Sex	Group I		Group II		Group III		TOTAL	
	N	%	N	%	N	%	N	%
Male	444	(53.9)	253	(51.3)	230	(50.8)	927	(52.4)
Female	380	(46.1)	240	(48.7)	223	(49.2)	843	(47.6)
TOTAL	824	(100)	493	(100)	453	(100)	1,770	(100)

preventive care only, initially at age three, and again at ages four and five.

Not all patients were actually three years old at the time of their first appointment. Over the course of the first year of the program it became apparent that many children were not being called in for their first appointment before they reached their fourth birthday. Of the 809 patients that appeared in the first year of the study (Group I Year 1), 233 (28.8%) were four years old at the time of their first appointment. (The mean age of patients in Group I Year 1 was 3.82 years.) This led to a change in contact procedures in the second year of the study (Group II Year 1 and Group III Year 1). The lists of prospective study participants were divided according to month of birth, and patients were called in for their first appointment as soon after their third birthday as possible. This procedure reduced the proportion of four-year-olds in Group II Year 1 to 5.7%, and in Group III Year 1 to 3.9%. (The mean age of patients in both Group II Year 1 and Group III Year 1 was 3.40 years.)

Table 12 describes the distribution of patients by age at first appointment in each of the study groups. Not all patients first appeared in Year 1 of the study (see Table 9). Of the 827 patients in Group I, 18 (2.2%) appeared for the first time in Year 2 or Year 3. In Group II, 36 (7.3%) of the 495 patients did not appear until Year 2 or Year 3; and in Group III, 43 (9.5%) of the 453 patients appeared for the first time only in Year 2 or Year 3 of the study. For these patients initial care was provided in what was, for the majority of patients, a maintenance care year.

TABLE 12

DISTRIBUTION OF PATIENTS BY AGE AT FIRST
APPOINTMENT

Age	Group I		Group II		Group III		TOTAL	
	N	%	N	%	N	%	N	%
Less than 2.5 Years	1	(0.1)	0	(0.0)	0	(0.0)	1	(0.1)
2.5 to 2.9 Years	7	(0.8)	27	(5.5)	17	(3.8)	51	(2.9)
3.0 to 3.4 Years	106	(12.9)	267	(54.2)	243	(53.6)	616	(34.8)
3.5 to 3.9 Years	461	(55.9)	153	(31.0)	144	(31.8)	758	(42.8)
4.0 to 4.4 Years	218	(26.5)	29	(5.9)	25	(5.5)	272	(15.4)
4.5 to 4.9 Years	25	(3.0)	6	(1.2)	14	(3.1)	45	(2.5)
5.0 Years or More	6	(0.7)	11	(2.2)	10	(2.2)	27	(1.5)
TOTAL	824	(100)	493	(100)	453	(100)	1,770	(100)
MEAN	3.85		3.47		3.52		3.66	

Table 12 also shows that there was a considerable range in age at first appearance although the majority of patients ranged in age from three-and-a-half to four-and-a-half years in Group I (82.4%), and from three to four years in Group II (85.2%) and Group III (85.4%).

6. SOURCE AND TYPE OF CARE

6.1 Health Unit and Private Dentists

Initial screening examinations for patients in all three study groups were carried out by Regional Municipality of Waterloo Health Unit dental staff. (Parents were allowed to by-pass the Health Unit and take their children directly to their family dentist if they so requested.) Children requiring reparative treatment were then referred to private dentists.¹⁴ Preventive dental care (dental prophylaxis, topical fluoride treatment and a dental health lesson) was provided at the Health Unit to those children who would not be going on to see a private dentist.¹⁵ Patients who were not referred to private dentists were put on the Health Unit recall list. Once patients started to see private dentists they were not normally recalled by the Health Unit. The number of patients seen at the Health Unit, therefore, decreased each year of the program.

Table 13 shows the proportion of patients in each group and year who were considered Health Unit patients and the proportion who were considered private patients. A patient who saw a private dentist in a given year was considered to be a private patient whether or not he or she also received some diagnostic or preventive treatment at the Health Unit during that year. In Year 1 of the program 64.6% of the patients in Group I saw private dentists compared with 44.0% of the patients in Group II and 37.1% of the patients in Group III.

¹⁴ This treatment was provided free of charge as part of the incremental dental care program to children in Groups I and II only.

¹⁵ Health Unit personnel also made this treatment available to some patients whose private dentists did not wish to, or were not in a position to provide it.

TABLE 13

DISTRIBUTION OF HEALTH UNIT AND PRIVATE PATIENTS IN EACH GROUP AND YEAR

Group and Year	Health Unit Patients		Private Patients		TOTAL	
	N	%	N	%	N	%
Group I						
Year 1	286	(35.4)	523	(64.6)	809	(100)
Year 2	169	(23.1)	564	(76.9)	733	(100)
Year 3	48	(6.3)	717	(93.7)	765	(100)
Group II						
Year 1	257	(56.0)	202	(44.0)	459	(100)
Year 2	81	(20.4)	317	(79.6)	398	(100)
Year 3	76	(17.3)	363	(82.7)	439	(100)
Group III						
Year 1	258	(62.9)	152	(37.1)	410	(100)
Year 2	122	(34.8)	229	(65.2)	351	(100)
Year 3	78	(20.3)	307	(79.7)	385	(100)

It was expected that a majority of the private patients in each study group would be referred to private dentists only after an initial screening examination at the Health Unit. The proportion of patients in each group who saw a private dentist in Year 1 would therefore be expected to reflect the proportion requiring treatment beyond basic diagnostic and preventive care. However, patients who saw private dentists in Year 1 included both those referred to private dentists by the Health Unit and those taken directly to private dentists by their parents (by-passing the Health Unit entirely).

The proportion of private patients initially screened at the Health Unit was estimated indirectly as the proportion who received a swab test for caries development potential.¹⁶ In Group I Year 1, 53.5% of the private patients received a swab test. In Group II Year 1, 54.5%, and in Group III Year 1, 53.3% of the private patients received this test. It appears, then, that in Year 1 just over one-half of the private patients in each group were seen at the Health Unit and referred from there to private dentists, while just under one-half were taken directly to private dentists by their parents. Of all patients known to have been seen at the Health Unit in Year 1 (Health Unit patients plus private patients who received a swab test) 50.2% in Group I, 30.9% in Group II, and 24.3% in Group III were subsequently seen by a private dentist during the course of the year. These figures should reflect a greater need for reparative treatment on the part of patients in Group I (see Section 6.2).

¹⁶ All patients seen at the Health Unit were to be given this test. Over 95% of the Health Unit patients in each group received a swab test in Year 1.

The proportion of patients seeing private dentists rose in Years 2 and 3 for all groups and especially for Groups II and III. It appears that most of the new private patients in Groups II and III Year 2 were referred to private dentists after a second visit to the Health Unit in Year 1.

6.2 Diagnostic and Preventive Care and Other Treatment

It was suggested in the previous section that the higher incidence of Health Unit referrals to private dentists in Group I Year 1 (as compared to Groups II and III, Year 1) should be indicative of a greater need for reparative treatment among patients in Group I. Table 14 shows the percentage of patients in Groups I and II who received treatment in addition to routine diagnostic and preventive care in each year of the program.¹⁷

From Table 14 it can be seen that in Year 1 a higher proportion of patients in Group I (35.5%) than in Group II (19.8%) received treatment in addition to diagnostic and preventive care. In Group I, the proportion of patients receiving such treatment rose considerably in each of the following two years (in Year 2 to 44.6%; in Year 3 to 61.7%); while in Group II the proportion rose in Year 2 (to 39.4%) and then levelled off in Year 3 (38.0%).

No explanation could be found for the pronounced differences between the two groups in the proportion of patients requiring treatment in each year. While it is true that patients in Group I were younger than patients

¹⁷ No records were kept of reparative treatment provided to patients in Group III since this treatment was not paid for under the incremental dental care plan.

TABLE 14

DISTRIBUTION OF PATIENTS RECEIVING DIAGNOSTIC AND PREVENTIVE CARE ONLY
AND PATIENTS RECEIVING DIAGNOSTIC AND PREVENTIVE CARE AND OTHER TREATMENT IN
GROUPS I AND II IN EACH YEAR

Group and Year	Diagnostic and Preventive Care ONLY		Diagnostic and Preventive Care AND Other Treatment		TOTAL	
	N	%	N	%	N	%
Group I						
Year 1	522	(64.5)	287	(35.5)	809	(100)
Year 2	406	(55.4)	327	(44.6)	733	(100)
Year 3	293	(38.3)	472	(61.7)	765	(100)
Group II						
Year 1	368	(80.2)	91	(19.8)	459	(100)
Year 2	241	(60.6)	157	(39.4)	398	(100)
Year 3	272	(62.0)	167	(38.0)	439	(100)

in Group I this does not appear to explain the differences.¹⁸

¹⁸ A sizeable minority (28.8%) of the patients in Group I Year 1 were four years old at the time of their first appointment under the dental care plan. Surprisingly, however, there was very little difference in the amount of dental treatment required on the part of the three-year olds as compared to the four-year-olds. Approximately 66% of the three-year-olds and 64% of the four-year-olds in Group I Year 1 required no extractions or fillings. The mean number of teeth extracted plus different teeth filled was 1.66 for three-year-olds and 1.70 for four-year-olds. Three-year-olds had a mean of 2.73 tooth surfaces filled compared to 2.88 for four-year-olds. Only 10 of the 233 four-year-olds in Group I Year 1 required extractions. These figures suggest that it might be satisfactory to begin dental treatment at four rather than three years of age. Further research on the optimal age for beginning children's dental treatment is recommended.

7. DIAGNOSTIC AND PREVENTIVE CARE

7.1 Examinations

The original schedule of dental services covered under the incremental dental care plan provided for one annual examination (see Section 3.4). This was changed in the second year of the study to two annual examinations to allow for common six-month recall practice. The mean number of examinations billed per patient was -- Group I: Year 1, 1.29; Year 2, 1.37; Year 3, 1.53; Group II: Year 1, 1.52; Year 2, 1.45; Year 3, 1.23; Group III: Year 1, 1.50; Year 2, 1.38; Year 3, 1.19. Table 15 indicates the frequency of paid-for dental examinations conducted by the Health Unit and private dentists in each group and year.

Although all patients who participated in the dental care program in a given year received a dental examination, in a few cases no examination was billed. Column 1 of Table 15, "Not Done", contains those cases in which an examination was not charged for even though some dental service was provided to that child in the indicated study year.

Judging by the number of patients who received a swab test (see section 6.1), 69% of the patients in Group I Year 1 were seen at the Health Unit. Because only one annual examination was to be billed, however, the Health Unit generally did not charge for an examination if the patient was referred to a private dentist. In the second year of the study (Groups II and III Year 1) when two annual examinations were allowed, the Health Unit did charge for examinations when patients were being referred to private dentists (Column 4, Table 15, "Done Once by

Health Unit and Once by Private Dentist"), and provided and charged for two dental examinations at the Health Unit in some cases (Column 3, Table 15, "Done Twice by Health Unit").

Although the change in the number of examinations allowed per year obviously had some effect on Health Unit practice, this effect is equivocal. Of those patients who apparently had examinations at the Health Unit only (Table 15, Column 2 "Done Once by Health Unit" and Column 3 "Done Twice by Health Unit"), the proportion of patients who had two examinations went from 5.3% in Group I Year 1 to 2.5% in Year 2 and 2.1% in Year 3. Thus it was highest before the rule was changed. In Group II the proportion rose from 35.7% in Year 1 to 37.0% in Year 2 and dropped to 5.4% in Year 3 although no rule change occurred. In Group III the proportion dropped steadily over the three years of the study from 37.5% in Year 1 to 21.8% in Year 2, and 2.6% in Year 3.

Private dentists also billed for two dental examinations in some cases in Group I Year 1 (contrary to the rules for payment which had been established). If one considers those patients who apparently had examinations by private dentists only (Table 15, Column 5 "Done Once by Private Dentist", and Column 6 "Done Twice by Private Dentist"), the proportion of cases in which the dentist billed for two examinations in one year rose, for patients in Group I, in Years 2 and 3 of the study (that is, after the rule changed). On the other hand, proportionally fewer patients in Groups II and III Year 1 received two paid-for examinations by a private dentist than in Group I Year 1 even though two examinations were allowed for Groups II and III Year 1 and were not allowed for Group I Year 1.

Moreover, the proportion of patients having two examinations by private dentists increased in Groups II and III Year 2 even though no change in the rules took place. Finally, in Year 3 of the study the proportion of patients in Groups II and III receiving two examinations decreased while it increased in Group I.¹⁹

Table 16 shows the distribution of the total number of examinations undergone by patients in the three study groups over all years of their participation in the study.

7.2 Bitewing Radiographs

The original schedule of services covered under the incremental dental care plan allowed for the taking of bitewing radiographs in Year 1 and 3 only for each group. A decision was taken after the first year of the program to change the rule to permit the taking of radiographs in Year 2 also.²⁰ However, because this change had not been specifically provided for in the budget for 1972, it was decided to record radiographs taken for patients in Group I Year 2 as "miscellaneous operations".

¹⁹ The proportion of patients having examinations by private dentists only who received two examinations was -- Group I: Year 1, 31.9%; Year 2, 44.1%; Year 3, 47.8%; Group II: Year 1, 27.5%; Year 2, 46.1%; Year 3, 22.1%; Group III: Year 1, 29.6%; Year 2, 41.7%; Year 3, 17.9%.

²⁰ Radiographs were to be taken in Year 2 of the study only if they were necessary and not as a matter of routine.

TABLE 16

TOTAL NUMBER OF EXAMINATIONS
OVER ALL YEARS OF PATIENTS' PARTICIPATION IN THE PROGRAM

Total Number of Examinations	Group I		Group II		Group III		TOTAL	
	N	%	N	%	N	%	N	%
1	28	(3.4)	26	(5.3)	40	(8.8)	94	(5.3)
2	66	(8.0)	75	(15.2)	66	(14.6)	207	(11.7)
3	224	(27.2)	108	(21.9)	115	(25.4)	447	(25.3)
4	235	(28.5)	131	(26.6)	128	(28.3)	494	(27.9)
5	189	(22.9)	135	(27.4)	97	(21.4)	421	(23.8)
6	79	(9.6)	17	(3.4)	7	(1.5)	103	(5.8)
7	3	(0.4)	1	(0.2)	0	(0.0)	4	(0.2)
TOTAL	824	(100)	493	(100)	453	(100)	1,770	(100)
MEAN	3.90		3.67		3.44		3.72	

Budget proposals for the following year, 1973, provided for radiographs for patients in Groups II and III Year 2 and, therefore, radiographs taken for these patients were recorded as such. The mean number of sets of radiographs billed per patient was -- Group I: Year 1, 0.55; Year 2, 0.01; Year 3, 0.87; Group II: Year 1, 0.54; Year 2, 0.64; Year 3, 0.67; Group III: Year 1, 0.56; Year 2, 0.52; Year 3, 0.60.

Table 17 shows the frequency with which bitewing radiographs were taken by the Health Unit and private dentists. Column 1 "Not Done" shows that bitewing radiographs were not taken in a substantial proportion of cases in each group and year.²¹ If taken at all, radiographs were generally taken only once per year in accordance with the guidelines for services covered under the incremental dental care plan.

Table 18 shows the percentage of all Health Unit and private patients having radiographs taken by group and year. The taking of radiographs was relatively infrequent among Health Unit patients. Of the 286 patients seen at the Health Unit and not referred to private dentists in Group I Year 1, 57 (19.9%) had radiographs taken. In Groups II and III Year 1 the proportion of Health Unit patients having radiographs taken increased. Of 257 Health Unit patients in Group II Year 1, 94 (36.6%) had radiographs taken; in Group III Year 1, 97 (37.6%) of 258 Health Unit patients had radiographs taken.

²¹ It is possible that in some cases radiographs were taken but not billed. These cases would be included in Table 17, Column 1 "Not Done". The Health Unit would presumably be less likely to bill in cases being referred to private dentists since only one pair of bitewing radiographs was allowed per year.

TABLE 17
FREQUENCY OF TAKING OF RADIOGRAPHS BY HEALTH UNIT AND PRIVATE DENTISTS BY GROUP AND YEAR

Group and Year	Radiographs																	
	Not Done		Done Once by Health Unit		Done Twice By Health Unit		Done Once by Health Unit & Once By Private Dentist		Done Once by Private Dentist		Done Twice by Private Dentist		Done More Than Twice		TOTAL			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
Group I																		
Year 1	380	(47.0)	51	(6.3)	0	(0.0)	3	(0.4)	359	(44.4)	16	(2.0)	0	(0.0)	809	(100)		
Year 2*	723	(98.6)	3	(0.4)	0	(0.0)	0	(0.0)	7	(1.0)	0	(0.0)	0	(0.0)	733	(100)		
Year 3	224	(29.3)	0	(0.0)	0	(0.0)	0	(0.0)	419	(54.8)	117	(15.3)	5	(0.7)	765	(100)		
Group II																		
Year 1	242	(52.7)	93	(20.3)	0	(0.0)	25	(5.4)	94	(20.5)	4	(0.9)	1	(0.2)	459	(100)		
Year 2	193	(48.5)	0	(0.0)	0	(0.0)	0	(0.0)	154	(38.7)	51	(12.8)	0	(0.0)	398	(100)		
Year 3	182	(41.5)	1	(0.2)	0	(0.0)	0	(0.0)	221	(50.3)	34	(7.7)	1	(0.2)	439	(100)		
Group III																		
Year 1	203	(49.5)	102	(24.9)	0	(0.0)	21	(5.1)	82	(20.0)	2	(0.5)	0	(0.0)	410	(100)		
Year 2	202	(57.5)	3	(0.9)	0	(0.0)	0	(0.0)	111	(31.6)	35	(10.0)	0	(0.0)	351	(100)		
Year 3	169	(43.9)	0	(0.0)	0	(0.0)	0	(0.0)	202	(52.5)	13	(3.4)	1	(0.3)	385	(100)		

* Radiographs were mainly coded as "miscellaneous operations" for this group and year. Statistics for miscellaneous operations were: Not done - 284 (38.7%); Done once - 414 (56.5%); Done twice - 34 (4.6%); Done 3 times - 1 (0.1%)

TABLE 18

PERCENTAGE OF ALL HEALTH UNIT AND PRIVATE PATIENTS HAVING
RADIOGRAPHS TAKEN BY GROUP AND YEAR

Group and Year	Health Unit Patients		Private Patients		TOTAL	
	Number	% Having Radiographs Taken	Number	% Having Radiographs Taken	Number	% Having Radiographs Taken
Group I	N	%	N	%	N	%
Year i	286	(19.9)	523	(71.1)	809	(53.0)
Year 2*	169	(1.8)	564	(1.2)	733	(1.4)
Year 3	48	(2.1)	717	(75.3)	765	(70.7)
Group II						
Year 1	257	(36.6)	202	(60.9)	459	(47.3)
Year 2	81	(1.2)	317	(64.4)	398	(51.5)
Year 3	76	(3.9)	363	(70.0)	439	(58.5)
Group III						
Year 1	258	(37.6)	152	(72.4)	410	(50.5)
Year 2	122	(3.3)	229	(63.3)	351	(42.5)
Year 3*	78	(0.0)	307	(70.4)	385	(56.1)

* See footnote Table 17

No change in the rules with respect to the taking of bitewing radiographs accounts for the increase in the proportion of Health Unit cases in which radiographs were taken in Groups II and III Year 1 as compared to Group I Year 1. Possible explanations were explored. Radiographs were recorded as miscellaneous operations in Group I Year 2. If all miscellaneous operations for Health Unit patients in that group and year are considered to have been radiographs,²² it appears that 56 (33.1%) of the 169 Health Unit patients seen in Group I Year 2 had radiographs taken. This figure (similar to the figures for Groups II and III Year 1) suggests that it may have been changes occurring at the Health Unit in the year 1972 (e.g. availability of equipment, personnel etc.) that resulted in the increase in the proportion of Health Unit patients having radiographs taken rather than any differences between the study groups.

The number of Health Unit patients having radiographs taken dropped almost to zero in Group I Year 3 and Groups II and III Years 2 and 3 (that is, 1973 and 1974).

Private patients were more likely than Health Unit patients to have radiographs taken. Between approximately 60% and 75% of the private patients in each group and year had radiographs taken. This percentage remained relatively constant across groups and years.

Table 19 shows the distribution of the total number of times patients had radiographs taken over all years of their participation in the study.

²² Since miscellaneous operations were recorded for only 3 other Health Unit patients of all those seen in other groups and years, this assumption appears reasonable.

TABLE 19

TOTAL NUMBER OF TIMES RADIOGRAPHS
WERE TAKEN OVER ALL YEARS OF PATIENTS'
PARTICIPATION IN THE PROGRAM

Total Number of Times Radiographs Were Taken	Group I*		Group II		Group III		TOTAL	
	N	%	N	%	N	%	N	%
0	170	(20.6)	123	(24.9)	119	(26.3)	412	(23.3)
1	288	(35.0)	120	(24.3)	138	(30.5)	546	(30.8)
2	273	(33.1)	136	(27.6)	115	(25.4)	524	(29.6)
3	84	(10.2)	72	(14.6)	54	(11.9)	210	(11.9)
4	8	(1.0)	30	(6.1)	21	(4.6)	59	(3.3)
5	1	(0.1)	10	(2.0)	5	(1.1)	16	(0.9)
6	0	(0.0)	1	(0.2)	1	(0.2)	2	(0.1)
7	0	(0.0)	1	(0.2)	0	(0.0)	1	(0.1)
TOTAL	824	(100)	493	(100)	453	(100)	1,770	(100)
MEAN	1.36		1.60		1.42		1.45	

* The total number of times radiographs were taken is underestimated for Group I due to a coding decision in Year 2. (See footnote Table 17.)

7.3 Topical Fluoride Applications

All topical fluoride applications were to be preceded by a dental prophylaxis. The original schedule of services covered under the incremental dental care plan allowed for one annual topical fluoride application per patient. This was changed in the second year of the study to two annual topical fluoride applications per patient. It was stressed, however, that a second topical fluoride application in one year was not to be done routinely but only if required by a particular child. The mean number of topical fluoride applications billed per patient was -- Group I: Year 1, 1.00; Year 2, 0.95; Year 3, 1.07; Group II: Year 1, 1.26; Year 2, 1.05; Year 3, 0.89; Group III: Year 1, 1.32; Year 2, 1.14; Year 3, 0.84.

Table 20 shows the frequency with which topical fluoride applications were done by the Health Unit and private dentists in each group and year. Table 21 shows the percentage of all Health Unit and private patients having at least one topical fluoride application in each group and year.

Health Unit patients had at least one topical fluoride application in over 85% of all cases except in Groups II and III Year 3 (1974) when the percentages dropped to 50% and 45% respectively. Among private patients, the percentage having at least one topical fluoride application ranged from 70% to 88% with no sharp fluctuations.

As was the case with examinations, the Health Unit did not tend to bill for two topical fluoride applications (Table 20, Column 3 "Done Twice by Health Unit") or for one topical fluoride application when a patient was

TABLE 21

PERCENTAGE OF ALL HEALTH UNIT AND PRIVATE PATIENTS HAVING APPLICATIONS OF TOPICAL
FLUORIDE (INCLUDING PROPHY) BY GROUP AND YEAR

Group and Year	Health Unit Patients		Private Patients		TOTAL	
	Number	% Having Topical Fluoride Applications	Number	% Having Topical Fluoride Applications	Number	% Having Topical Fluoride Applications
	N	%	N	%	N	%
Group I						
Year 1	286	(98.6)	523	(88.0)	809	(91.7)
Year 2	169	(89.9)	564	(74.6)	733	(78.2)
Year 3	48	(85.4)	717	(76.3)	765	(76.9)
Group II						
Year 1	257	(99.2)	202	(81.7)	459	(91.5)
Year 2	81	(98.8)	317	(70.0)	398	(75.9)
Year 3	76	(50.0)	363	(79.9)	439	(74.7)
Group III						
Year 1	258	(98.4)	152	(82.9)	410	(92.7)
Year 2	122	(98.4)	229	(79.9)	351	(86.3)
Year 3	78	(44.9)	307	(80.5)	385	(73.2)

being referred to a private dentist (Table 20, Column 4 "Done Once by Health Unit and Once by Private Dentist") in Group I Year 1 when the rules allowed only one topical fluoride application per year. On the other hand, the proportion of patients in Group I who had two topical fluoride applications done by the Health Unit was low throughout the study.

Of those patients having topical fluoride applications done at the Health Unit only (Table 20, Column 2 "Done Once by Health Unit" and Column 3 "Done Twice by Health Unit"), the proportion in Group I having two such applications was 2.3% in Year 1, 3.2% in Year 2, and 2.2% in Year 3. The number of patients in Group I having one topical fluoride application done at the Health Unit and one by a private dentist in the same year was also low throughout the study.

A relatively higher proportion of patients in Groups II and III Years 1 and 2 had two topical fluoride applications done at the Health Unit (Group II Year 1, 29.2%, Group II Year 2, 30.7%; Group III, Year 1, 32.5%; Group III Year 2, 19.7%). In both Groups II and III Year 1, an additional 13% of all patients had one topical fluoride application done at the Health Unit and one by a private dentist. In Groups II and III Years 2 and 3 the proportion of all patients having one topical fluoride application done at the Health Unit and one by a private dentist dropped to between 1% and 2%. Moreover in Year 3 only one patient in Group II and none in Group III had two topical fluoride applications done at the Health Unit.

Of those patients having topical fluoride applications done by private dentists only (Table 20, Column 5 "Done Once by Private Dentist", and Column 6 "Done Twice by Private Dentist") the proportion having two such applications rose steadily in Group I from Year 1 (before the rule was changed to allow two annual topical fluoride applications) to Year 3.²³ In Groups II and III, the proportion having two topical fluoride applications done by a private dentist also rose between Years 1 and 2 (although no rule change occurred), however the proportion dropped in Groups II and III in Year 3 instead of continuing to rise as it did in Group I Year 3.²⁴ A similar pattern was observed in the case of examinations (see Section 7.1).

Table 22 shows the distribution of the total number of topical fluoride applications undergone by patients over all years of their participation in the study.

7.4 Summary and Discussion

The frequency of dental examinations, bitewing radiographs and topical fluoride applications under the incremental dental care program was apparently influenced by several factors including: patients' needs, dentists' practice standards, rules governing payment, and availability of time or personnel.

²³ The figures were: Year 1, 9.9%; Year 2, 27.0%; Year 3, 36.5%.

²⁴ The figures were: Group II Year 1, 20.0%; Year 2, 41.0%; Year 3, 18.6%; Group III Year 1, 32.6%; Year 2, 36.6%, Year 3, 12.6%.

TABLE 22

TOTAL NUMBER OF APPLICATIONS OF TOPICAL FLUORIDE
(INCLUDING PROPHY) OVER ALL YEARS OF PATIENTS' PARTICIPATION IN THE PROGRAM

Total Number of Applications of Topical Fluoride (including prophy)	Group I		Group II		Group III		TOTAL	
	N	%	N	%	N	%	N	%
0	21	(2.5)	21	(4.3)	17	(3.8)	59	(3.3)
1	103	(12.5)	86	(17.4)	80	(17.7)	269	(15.2)
2	202	(24.5)	111	(22.5)	101	(22.3)	414	(23.4)
3	273	(33.1)	109	(22.1)	99	(21.9)	481	(27.2)
4	148	(18.0)	93	(18.9)	99	(21.9)	340	(19.2)
5	62	(7.5)	66	(13.4)	54	(11.9)	182	(10.3)
6	14	(1.7)	6	(1.2)	3	(0.7)	23	(1.3)
7	1	(0.1)	1	(0.2)	0	(0.0)	2	(0.1)
TOTAL	824	(100)	493	(100)	453	(100)	1,770	(100)
MEAN	2.81		2.80		2.79		2.80	

Dentists were instructed to take bitewing radiographs in year 2 of the study and to provide a second annual topical fluoride application only in cases of special patient need. The frequency with which dentists provided other diagnostic and preventive services was probably influenced by patient needs to a greater extent for some dentists than for others who were more inclined to provide services routinely to all their patients. The results of the study suggest that in the judgment of some dentists even once yearly radiographs are unnecessary for some young children (those with so-called "spaced" dentitions among others). Similarly bi-annual examinations and topical fluoride applications were not provided routinely to all patients by all participating dentists.

Some dentists were probably influenced by the rules regarding payment for services more than others. On the whole, however, the rules limiting the services paid for under the plan seem to have had very little effect on the private dentists who participated in the program. This was due at least in part to the fact that the rules were neither strictly enforced nor as clear as they should have been. Dentists were paid for diagnostic and preventive services rendered more frequently than the rules permitted. Consequently, changes in the rules had little effect. The Health Unit staff was more sensitive to the rules limiting the frequency of services to be rendered. The Health Unit apparently did not bill for examinations conducted in Group I Year 1 if patients were being referred to private dentists, and did not bill for two examinations conducted at the Health Unit since only one examination was to be paid for in that year. When the rule was changed to allow for two examinations per year for patients

in Groups II and III Year 1, the Health Unit responded in some cases by providing and billing for two examinations at the Health Unit, and in other cases by billing for one examination at the Health Unit when a referral was being made to a private dentist.

In some instances the frequency of services rendered was influenced by the availability of time or personnel. Virtually no radiographs were taken at the Health Unit in the third and final years of the study (1973, 1974). Similarly, the proportion of Health Unit patients receiving two dental examinations and the proportion having topical fluoride applications dropped considerably in the final year. This reduction in services can be accounted for by cutbacks in personnel.

8. OTHER TREATMENT

8.1 Extractions and Fillings

Under the incremental dental care plan all treatment other than basic diagnostic and preventive care was to be carried out by private dentists. This other treatment was to be provided free of charge to children in Groups I and II only.

Table 23 shows the total number of teeth extracted plus different teeth filled, by year, for patients in Groups I and II.²⁵ In Group I Year 1, 65% of the patients seen did not require any extractions or fillings; in Group II Year 1 the proportion was 80%. The mean number of teeth extracted plus different teeth filled was 1.67 in Group I Year 1, and 0.88 in Group II Year 1. In each of the two maintenance years (Years 2 and 3), Group II had a lower proportion of children requiring extractions or fillings and a lower mean number of teeth extracted plus teeth filled than Group I. In Group I, however, the proportion of children requiring extractions or fillings and the mean number of teeth extracted plus teeth filled decreased in the first maintenance year (Year 2) and increased again in the second maintenance year (Year 3) while in Group II there was an increase in Year 2 and a decrease in Year 3.

²⁵ See also Appendix D, Table D.1, Number of Teeth Extracted by Group and Year, and Table D.2, Number of Different Teeth Filled by Group and Year.

TABLE 23
NUMBER OF TEETH EXTRACTED PLUS DIFFERENT TEETH FILLED BY GROUP AND YEAR

Number of Teeth Extracted Plus Different Teeth Filled	Group I						Group II					
	Year 1		Year 2		Year 3		Year 1		Year 2		Year 3	
	N	%	N	%	N	%	N	%	N	%	N	%
0	525	(64.9)	408	(55.7)	296	(38.7)	368	(80.2)	241	(60.6)	273	(62.2)
1	43	(5.3)	85	(11.6)	98	(12.8)	16	(3.5)	35	(8.8)	38	(8.7)
2	52	(6.4)	80	(10.9)	111	(14.5)	17	(3.7)	32	(8.0)	47	(10.7)
3	30	(3.7)	41	(5.6)	69	(9.0)	14	(3.1)	25	(6.3)	26	(5.9)
4	34	(4.2)	40	(5.5)	69	(9.0)	10	(2.2)	18	(4.5)	20	(4.6)
5	22	(2.7)	22	(3.0)	31	(4.1)	4	(0.9)	18	(4.5)	9	(2.1)
6	35	(4.3)	20	(2.7)	30	(3.9)	5	(1.1)	7	(1.8)	8	(1.8)
7	15	(1.9)	11	(1.5)	22	(2.9)	6	(1.3)	8	(2.0)	3	(0.7)
8	19	(2.3)	14	(1.9)	15	(2.0)	8	(1.7)	5	(1.3)	6	(1.4)
9+	34	(4.2)	12	(1.6)	24	(3.1)	11	(2.4)	9	(2.3)	9	(2.1)
TOTAL	809	(100)	733	(100)	765	(100)	459	(100)	398	(100)	439	(100)
MEAN	1.67		1.47		2.18		0.88		1.43		1.26	

Table 24 shows the number of tooth surfaces filled, by year, for patients in Groups I and II.²⁶ In Group I Year 1, an average of 2.78 tooth surfaces were filled per patient; in Group II Year 1, 1.28 tooth surfaces were filled per patient. Again, in Group I, the average number of tooth surfaces filled decreased in Year 2 and increased in Year 3, while in Group II the number increased in Year 2 and decreased in Year 3.

Tables 25 and 26 show the total number of teeth extracted plus different teeth filled, and the total number of tooth surfaces filled over all years of patients' participation in the program.²⁷ Patients in Group I had an average of 4.95 teeth extracted or filled in the course of their participation in the program; patients in Group II had an average of 3.09 teeth extracted or filled. Just over one-quarter (27.5%) of the patients in Group I required no extractions or fillings at all, while in Group II, one-half (49.9%) of the patients required no extractions or fillings. In Group I, 37.6% of the patients required more than five extractions or fillings; in Group II the proportion was 22.1%. The average total number of tooth surfaces filled was 7.88 for patients in Group I and 4.65 for patients in Group II.

8.2 Pulpotomies

Pulpotomies were another form of treatment covered under the incremental dental care plan for children in Groups I and II only. Very few were

²⁶ See also Appendix D, Table D.3, Number of One-Surface Fillings by Group and Year; Table D.4 Number of Two-Surface Fillings by Group and Year; and Table D.5, Number of Three- and Four-Surface Fillings and Full Crowns by Group and Year.

²⁷ See also Appendix D, Tables D.2, D.4, D.6, D.8, D.10.

TABLE 24

NUMBER OF TOOTH SURFACES FILLED BY GROUP AND YEAR

Number of Tooth Surfaces Filled	Group I						Group II					
	Year 1		Year 2		Year 3		Year 1		Year 2		Year 3	
	N	%	N	%	N	%	N	%	N	%	N	%
0	525	(64.9)	418	(57.0)	316	(41.3)	370	(80.6)	243	(61.1)	282	(64.2)
1	34	(4.2)	47	(6.4)	48	(6.3)	14	(3.1)	22	(5.5)	17	(3.9)
2	40	(4.9)	59	(8.0)	84	(11.0)	11	(2.4)	25	(6.3)	33	(7.5)
3	25	(3.1)	33	(4.5)	37	(4.8)	7	(1.5)	17	(4.3)	11	(2.5)
4	28	(3.5)	39	(5.3)	67	(8.8)	15	(3.3)	25	(6.3)	31	(7.1)
5	13	(1.6)	25	(3.4)	24	(3.1)	6	(1.3)	12	(3.0)	8	(1.8)
6-10	70	(8.7)	68	(9.3)	127	(16.7)	16	(3.5)	33	(8.3)	39	(8.9)
11-15	43	(5.3)	27	(3.7)	45	(5.9)	12	(2.6)	12	(3.0)	13	(3.0)
16-20	12	(1.5)	17	(2.3)	15	(2.0)	6	(1.3)	4	(1.0)	5	(1.1)
21+	19	(2.3)	0	(0.0)	2	(0.2)	2	(0.4)	5	(1.3)	0	(0.0)
TOTAL	809	(100)	733	(100)	765	(100)	459	(100)	398	(100)	439	(100)
MEAN	2.78		2.31		3.36		1.28		2.22		1.89	

TABLE 25

TOTAL NUMBER OF TEETH EXTRACTED PLUS DIFFERENT TEETH FILLED OVER ALL YEARS
OF PATIENTS' PARTICIPATION IN THE PROGRAM

Total Number of Teeth Extracted Plus Different Teeth Filled	Group I		Group II		TOTAL	
	N	%	N	%	N	%
0	227	(27.5)	246	(49.9)	473	(35.9)
1	74	(9.0)	21	(4.3)	95	(7.2)
2	72	(8.7)	45	(9.1)	117	(8.9)
3	49	(5.9)	23	(4.7)	72	(5.5)
4	51	(6.2)	28	(5.7)	79	(6.0)
5	41	(5.0)	21	(4.3)	62	(4.7)
6-10	185	(22.5)	64	(13.0)	249	(18.9)
11-15	81	(9.8)	37	(7.5)	118	(8.9)
16-20	33	(4.0)	6	(1.2)	39	(3.0)
21+	11	(1.3)	2	(0.4)	13	(1.0)
TOTAL	824	(100)	493	(100)	1,317	(100)
MEAN	4.95		3.09		4.25	

TABLE 26

TOTAL NUMBER OF TOOTH SURFACES FILLED OVER ALL YEARS OF PATIENTS'
PARTICIPATION IN THE PROGRAM

Total Number of Tooth Surfaces Filled	Group I		Group II		TOTAL	
	N	%	N	%	N	%
0	236	(28.6)	250	(50.7)	486	(36.9)
1	43	(5.2)	12	(2.4)	55	(4.2)
2	62	(7.5)	33	(6.7)	95	(7.2)
3	33	(4.0)	14	(2.8)	47	(3.6)
4	54	(6.6)	23	(4.7)	77	(5.8)
5	27	(3.3)	17	(3.4)	44	(3.3)
6-10	117	(14.2)	63	(12.8)	180	(13.7)
11-15	94	(11.4)	29	(5.9)	123	(9.3)
16-20	78	(9.5)	26	(5.3)	104	(7.9)
21+	80	(9.7)	26	(5.3)	106	(8.0)
TOTAL	824	(100)	493	(100)	1,317	(100)
MEAN	7.88		4.65		6.67	

performed. The number of patients who received pulpotomies in each group and year were: Group I -- Year 1, 14; Year 2, 10; Year 3, 21; Group II -- Year 1, 3; Year 2, 7; Year 3, 4.

8.3 Space Maintainers

Space maintainers were to be provided free of charge to children in Groups I and II. In fact, very few were placed. The number of patients who had space maintainers placed in each group and year were Group I -- Year 1, 4; Year 2, 14; Year 3, 22; Group II -- Year 1, 1; Year 2, 2; Year 3, 8.

8.4 Summary and Discussion

From these results it appears that the dental treatment needs of pre-school children three to five years of age are uneven from year to year. There is a range of between slightly less than one and almost two teeth requiring filling or extraction, or between 1.3 to 3.4 tooth surfaces requiring filling per year. Usually well over one-half of the patients in each age group do not require any fillings. Pulpotomies and space maintainers are required only infrequently when dental care is provided routinely.

9. USE OF DENTAL MANPOWER

9.1 Number of Appointments

The number of dental appointments which each child participating in the study had²⁸ (per year, and over the whole course of his or her participation in the incremental dental care program) was related to the amount of diagnostic and preventive care and other treatment which the child received.

Table 27 shows the number of appointments per patient in each group and year. Group III had the lowest number of appointments per patient of the three study groups, in each year. This reflects the fact that only diagnostic and preventive care was provided to patients in Group III under the dental care plan. Between nearly one-half and three-quarters of the Group III patients seen in each year had only one appointment. No Group III patient ever had more than four appointments in a single year. The average number of appointments per patient was almost the same in the initial year (Group III Year 1, 1.59) and the first maintenance year (Group III Year 2, 1.54). In the second maintenance year the average number of appointments per patient dropped to 1.30.

In Group I also, the average number of appointments per patient was almost the same in the initial year of the study (Group I Year 1, 2.30) and in the first maintenance year (Group I Year 2, 2.21). However in the second maintenance year the average number of appointments per patient rose, in Group I, to 2.72, while it dropped in Group III.

²⁸ This refers to appointments which were kept. For data on broken appointments see Section 9.3.

TABLE 27
NUMBER OF APPOINTMENTS BY GROUP AND YEAR

Group and Year	Number of Appointments																		TOTAL		
	1		2		3		4		5		6		7		8		9+		TOTAL		MEAN
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	
Group I																					
Year 1	337	(41.6)	208	(25.7)	111	(13.7)	62	(7.7)	45	(5.6)	26	(3.2)	12	(1.5)	5	(0.6)	3	(0.4)	809	(100)	2.30
Year 2	286	(39.0)	222	(30.3)	114	(15.5)	49	(6.7)	37	(5.0)	14	(2.0)	9	(1.2)	0	(0.0)	2	(0.3)	733	(100)	2.21
Year 3	191	(25.0)	232	(30.3)	148	(19.3)	82	(10.7)	62	(8.1)	27	(3.6)	11	(1.4)	6	(0.8)	6	(0.8)	765	(100)	2.72
Group II																					
Year 1	174	(37.9)	205	(44.7)	37	(8.1)	17	(3.7)	17	(3.7)	5	(1.1)	4	(0.8)	0	(0.0)	0	(0.0)	459	(100)	1.97
Year 2	124	(31.2)	160	(40.2)	53	(13.3)	27	(6.8)	19	(4.8)	7	(1.7)	3	(0.8)	4	(1.0)	1	(0.2)	398	(100)	2.29
Year 3	226	(51.5)	112	(25.5)	56	(12.8)	23	(5.2)	10	(2.3)	6	(1.4)	4	(0.9)	0	(0.0)	2	(0.4)	439	(100)	1.92
Group III																					
Year 1	192	(46.8)	199	(48.5)	16	(3.9)	3	(0.8)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	410	(100)	1.59
Year 2	204	(58.1)	115	(32.8)	23	(6.6)	9	(2.6)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	351	(100)	1.54
Year 3	282	(73.2)	93	(24.2)	8	(2.1)	2	(0.5)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	385	(100)	1.30

In Group II, the average number of appointments per patient was approximately the same in the initial year (Group II Year 1, 1.97) and the second maintenance year (Group II Year 3, 1.92), after having risen in the first maintenance year to 2.29.

In Groups I and II, between approximately one-quarter and one-half of the patients seen in each year of the study had only one dental appointment. This reflects the fact that while all patients in Groups I and II were eligible to receive treatment in addition to basic diagnostic and preventive care, not all actually required such treatment (see Section 6.2).

Table 28 shows the average number of appointments in each group and year for patients receiving basic diagnostic and preventive care only and for those receiving treatment in addition to basic care.

Table 29 shows the distribution of the total number of appointments for patients in each group over their entire participation in the study. Group I had the highest average number of appointments (6.73). Approximately 15% of the patients in Group I had between one and three appointments; 40% had between four and six appointments; and 45% had seven or more appointments over the course of their participation in the program. In Group II, 25% of the patients had one to three appointments; 50% had four to six appointments; and 25% had seven or more appointments. The average number of appointments per patient was 5.37. In Group III, 43% had one to three appointments; 53% had four to six appointments; and only 4% had

TABLE 29

TOTAL NUMBER OF APPOINTMENTS OVER
ALL YEARS OF PATIENTS' PARTICIPATION IN THE PROGRAM

Total Number of Appointments	Group I		Group II		Group III	
	N	%	N	%	N	%
1	18	(2.2)	16	(3.2)	37	(8.2)
2	31	(3.8)	39	(7.9)	54	(11.9)
3	72	(8.7)	67	(13.6)	105	(23.2)
4	83	(10.1)	69	(14.0)	117	(25.8)
5	127	(15.4)	117	(23.7)	102	(22.5)
6	118	(14.3)	60	(12.2)	21	(4.6)
7	107	(13.0)	39	(7.9)	12	(2.6)
8	61	(7.4)	24	(4.9)	4	(0.9)
9+	207	(25.1)	62	(12.6)	1	(0.2)
TOTAL	824	(100)	493	(100)	453	(100)
MEAN	6.73		5.37		3.73	

seven or more appointments. The average was 3.73 appointments per patient over the entire period of the study.

9.2 Chairtime

Private dentists and Health Unit staff indicated the amount of time devoted to each patient by checking the appropriate time interval on the patient record form (see Appendix C). There are two problems with these data. Firstly, they are probably not always accurate. Secondly, while the first seven categories which were coded for computer analysis represented fifteen-minute intervals (from "1 to 15" to "91 to 105" minutes), the last category, coded "More than 105" minutes, had no defined upper limit. This made calculation of the mean problematic. The mean was calculated using the midpoint of each time interval, considering "More than 105" as a fifteen-minute interval (106 to 120 minutes).

Table 30 shows the distribution of chairtime by group and year. Table 31 shows the distribution of chairtime for patients who received basic diagnostic and preventive care only and for those who also received other treatment.

9.3 Broken Appointments

Private dentists participating in the incremental dental care plan were not to be paid for broken appointments. Broken appointments did not, however, prove to be a serious problem.

Table 32 shows the number of patients breaking appointments in each group and year. The highest proportion of patients breaking appointments was 6.5% in Group III Year 3. The lowest proportion was 1.1% in Group II

TABLE 31
DISTRIBUTION OF CHAIRTIME OF PATIENTS RECEIVING DIAGNOSTIC AND PREVENTIVE CARE ONLY AND PATIENTS
RECEIVING DIAGNOSTIC AND PREVENTIVE CARE AND OTHER TREATMENT BY GROUP AND YEAR

Group and Year	Diagnostic and Preventive Care ONLY Chairtime (in minutes)										Diagnostic and Preventive Care AND Treatment Chairtime (in minutes)																					
	1 to 30			31 to 60			More than 60			TOTAL		MEAN		1 to 30		31 to 60		More than 60		TOTAL		MEAN										
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%												
Group I	447	(85.8)			69	(13.2)			5	(1.0)			521*			17.10					89	(31.0)			178	(62.0)			287	(100)	76.35	
	332	(81.8)			71	(17.5)			3	(0.7)			406			18.00					119	(36.4)			169	(51.7)			327	(100)	67.35	
	195	(66.6)			81	(27.6)			17	(5.8)			293			26.55					134	(28.4)			299	(63.3)			472	(100)	75.45	
Group II	312	(84.8)			54	(14.7)			2	(0.5)			368			18.45					21	(23.1)			58	(63.7)			91	(100)	74.40	
	181	(75.1)			47	(19.5)			13	(5.4)			241			23.85					42	(26.9)			98	(62.8)			156*	(100)	71.85	
	221	(81.3)			49	(18.0)			2	(0.7)			272			19.35					60	(35.9)			88	(52.7)			167	(100)	67.80	
Group III	344	(83.9)			64	(15.6)			2	(0.5)			410			18.45					-				-					-		-
	275	(78.3)			64	(18.2)			12	(3.4)			351			22.20					-				-					-		-
	311	(80.8)			69	(17.9)			5	(1.3)			385			20.85					-				-					-		-

* 1 patient had '0' minutes of chairtime recorded and is excluded from this table.

TABLE 32

NUMBER AND PERCENTAGE OF ALL PATIENTS BREAKING APPOINTMENTS BY GROUP AND YEAR

Group and Year	Patients Breaking Appointments	
	N	%
Group I		
Year 1	32	(4.0)
Year 2	32	(4.4)
Year 3	41	(5.4)
Group II		
Year 1	5	(1.1)
Year 2	15	(3.8)
Year 3	17	(3.9)
Group III		
Year 1	6	(1.5)
Year 2	14	(4.0)
Year 3	25	(6.5)

Year 1. At least one-half of the patients who broke appointments in each group and year broke only one appointment with the exception of Group III Year 3 in which 15 of the 25 patients breaking appointments broke more than one.

10. COST

Dentists participating in the incremental dental care plan were instructed to charge their usual fees for services provided to patients in the program. Under no circumstances, however, were these fees to exceed the guidelines set out by the Ontario Dental Association. In the first year of the study (1971), the 1969 Ontario Dental Association Fee Guide was used to set the upper limits for fees to be charged under the plan. In the second year of the study (1972), the limits on fees to be charged were raised in conformity with the 1971 Fee Guide. They remained at the latter level in the third and final years of the study (1973, 1974). (See Section 3.4).

Table 33 shows the cost of the services provided to patients under the incremental dental care plan. As was the case with number of appointments and chairtime, costs varied with the nature and extent of services provided in each group and year. Lower costs for patients in Group III reflect the fact that more limited services were provided to these patients under the plan. Lower costs for patients in Group II compared with patients in Group I (especially in Year 3) reflect lower levels of treatment for patients in Group II. Differences between the two groups in level of treatment were not expected and could not be explained. Table 34 shows the mean cost in each group and year for those patients receiving diagnostic and preventive care only and for those receiving diagnostic and preventive care and other treatment.

TABLE 33
COST BY GROUP AND YEAR

Group and Year		COST (in dollars)																							
		1 to 10		11 to 20		21 to 30		31 to 40		41 to 50		51 to 60		61 to 75		76 to 100		101 to 200		Over 200		TOTAL		MEAN	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
Group I																									
Year 1	41	(5.1)	441	(54.5)	98	(12.1)	55	(6.8)	27	(3.3)	27	(3.3)	42	(5.2)	39	(4.8)	32	(4.0)	7	(0.9)	809	(100)	31.26		
Year 2	1	(0.1)	64	(8.7)	305	(41.6)	122	(16.6)	62	(8.5)	47	(6.4)	29	(4.0)	27	(3.7)	36	(4.9)	40	(5.5)	733	(100)	32.87		
Year 3	51	(6.7)	178	(23.3)	119	(15.6)	109	(14.2)	65	(8.5)	47	(6.1)	51	(6.7)	77	(10.1)	64	(8.4)	4	(0.5)	765	(100)	46.14		
Group II																									
Year 1	18	(3.9)	209	(45.5)	146	(31.8)	28	(6.1)	7	(1.5)	8	(1.7)	18	(3.9)	11	(2.4)	12	(2.6)	2	(0.4)	459	(100)	27.15		
Year 2	40	(10.1)	130	(32.7)	87	(21.9)	50	(12.6)	23	(5.8)	14	(3.5)	15	(3.8)	21	(5.3)	17	(4.3)	1	(0.3)	398	(100)	32.98		
Year 3	96	(21.9)	154	(35.1)	47	(10.7)	36	(8.2)	34	(7.7)	18	(4.1)	17	(4.1)	18	(4.1)	16	(3.6)	3	(0.7)	439	(100)	30.21		
Group III																									
Year 1	28	(6.8)	205	(50.0)	159	(38.8)	18	(4.4)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	410	(100)	18.22		
Year 2	52	(14.8)	203	(57.8)	58	(16.5)	36	(10.3)	1	(0.3)	1	(0.3)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	351	(100)	16.69		
Year 3	103	(26.8)	232	(60.3)	33	(8.6)	16	(4.2)	0	(0.0)	1	(0.3)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	385	(100)	14.43		

TABLE 34

MEAN COST FOR PATIENTS RECEIVING DIAGNOSTIC AND PREVENTIVE
CARE ONLY AND PATIENTS RECEIVING DIAGNOSTIC AND PREVENTIVE CARE AND
OTHER TREATMENT BY GROUP AND YEAR

Group and Year	Mean Cost (in dollars)			TOTAL
	Diagnostic and Preventive Care ONLY	Diagnostic and Preventive Care AND Other Treatment		
Group I	\$	\$	\$	
Year 1	14.32 (N=522)	62.08 (N=287)	31.26 (N=809)	
Year 2	14.88 (N=406)	55.20 (N=327)	32.87 (N=733)	
Year 3	17.68 (N=293)	63.81 (N=472)	46.14 (N=765)	
Group II				
Year 1	17.96 (N=368)	64.31 (N=91)	27.15 (N=459)	
Year 2	16.94 (N=241)	57.59 (N=157)	32.98 (N=398)	
Year 3	13.26 (N=272)	57.81 (N=167)	30.21 (N=439)	
Group III				
Year 1	18.22 (N=410)	-	18.22 (N=410)	
Year 2	16.69 (N=351)	-	16.69 (N=351)	
Year 3	14.43 (N=385)	-	14.43 (N=385)	

Over the entire study the average cost²⁹ per patient was: Group I, \$102.46; Group II, \$78.38; Group III, \$41.69. The total cost of providing dental services to patients in the project was: Group I (N=827), \$84,680; Group II (N=495), \$38,850; Group III (N=453), \$18,884. The total cost for all patients was \$142,414.

The total cost for dental services would have been greater if all participating dentists had charged the maximum allowable fee for all services. Actual costs in each group and year were between 8% and 22% lower than they would have been had the maximum fees been charged in all cases.

Fees for dental services have risen markedly in recent years. If costs are calculated using fees set according to the 1975 Ontario Dental Association Fee Guide, the total cost of the dental services provided under the incremental dental care plan would be \$238,843. If it is assumed that the actual charges would again be 8% to 22% lower than this, the total cost would be between \$195,773 and \$221,150. This is between 38% and 55% higher than the actual costs of the dental services provided under the plan which, as mentioned, were based mainly on the 1971 Fee Guide prices.

²⁹ Costs referred to here are costs arising from payments to private dentists and the Health Unit for dental services only. They do not include administrative and research costs.

11. CONCLUSIONS

Some general conclusions can be drawn from the experience and findings of the Waterloo incremental dental care study:

- I This study has shown that it is feasible for a regional governmental agency (such as the dental division of a public health unit), to administer a private practice children's denticare scheme. The availability of adequate resources in terms of administrative personnel, and clear definition of the roles of the private practitioners and the agencies involved are important to the smooth functioning of such a scheme. These factors would become more crucial if larger numbers of children were eligible for care.
- II Although the extremely high utilization of the dental care plan by eligible children is partially attributable to the energy and initiative of the personnel administering it, it is also significant that a large proportion of parents contacted agreed to have their children participate upon receipt of the first contact letter.
- III A very high rate of dentist participation in the program was obtained without any major difficulties and the cooperation of the local dentists was generally excellent.
- IV Not all participating dentists charged the maximum allowable fee for each item of service rendered. This is especially noteworthy since the fee guide used in any given year was two to three calendar years behind the current year's fee guide.
- V Not all participating dentists routinely provided all diagnostic and preventive services with the frequency permitted under the plan.

- VI It is suggested that the notable variation in the amount of all types of dental services received by children of the same age was influenced by the following factors, among others:
- 1) Differing levels of dental disease attack -- levels of disease attack is in turn influenced by diet, oral hygiene, exposure to fluoridated water, etc.;
 - 2) Patterns of participation in the program -- children who appeared at regular intervals over the three years of the program did not receive the same care as those who appeared infrequently and sporadically;
 - 3) Differing practices among dentists -- some dentists provided much more frequent and comprehensive diagnostic and preventive services than others. Individual dentists probably also differ in the extent to which they provide reparative services.

APPENDIX A

FORMS SENT TO PATIENTS' PARENTS

WATERLOO COUNTY HEALTH UNIT

DENTAL DIVISION
Telephone Number 579-3120

THREE YEAR FREE DENTAL CARE PLAN

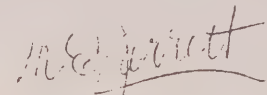
Dear Parent:

The Department of Health of Ontario through the Waterloo County Health Unit is offering dental care for one thousand three-year-olds in the county at no cost to the parent. The names have been drawn by computer from the assessment roll of the county in proportion to the number of three-year-olds in each municipality. Only those names selected are eligible.

has been one of the children selected. Participation in this program ensures complete dental care for your child this year through to age five. The accompanying sheet has a brief outline of the project.

The initial examination will be carried out by the Health Unit Dental Staff. Those families with no family dentist may select one from the list of participating dentists that will be available at the examination centres. We will require your signature on the consent form as "yes" or "no". If, at this time, you indicate that you do not wish your child to be in the study, you will not be able to reverse that decision later as your child's name will have been replaced in the project.

The starting date for examinations will be late March or early April and this year's group of one thousand children should have their work completed as soon thereafter as possible.



M. E. Jarrett D.D.S., D.D.P.H.
Director of Dental Health
Waterloo County Health Unit

Please fill in the blank space that applies to you. Sign your name and include your telephone number.

I wish to have _____ included in the free dental care project being conducted by the Waterloo County Health Unit.

Our family dentist is _____.

We have no family dentist and wish to select one from the list of dentists in our area for the dental treatment necessary _____.

We will make an appointment for you with the dentist of your choice if you do not have a family dentist, and you wish us to do so.

Birthdate of child _____
day/month/year

The school the child will be attending _____

Signature _____ Telephone number _____

If you have already filled in the above, disregard the next section.

I do not wish to have _____ included in the project.

Please state reason _____

Signature _____

WATERLOO COUNTY HEALTH UNIT

DENTAL DIVISION

Telephone Number 579-3120

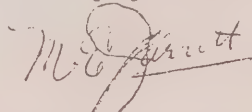
THREE YEAR FREE DENTAL CARE PLAN

Dear Parent:

The Department of Health of Ontario through the Waterloo County Health Unit is offering complete dental care for one thousand three-year-olds in the county at no cost to the parent. The names have been drawn by computer from the assessment roll of the county in proportion to the number of three-year-olds in each municipality. Only those names selected are eligible. _____ has been one of the children selected. Participation in this program ensures complete dental care for your child this year through to age five. The accompanying sheet has a brief outline of the project.

The initial examination will be carried out by the Health Unit Dental Staff. You will be contacted as to your appointment for the initial examination for your child. Any further dental work will be performed by your family dentist. We have a list of participating dentists for those who do not have a family dentist.

We will require your signature on the consent form as "yes" or "no". If, at this time, you indicate that you do not wish your child to be in the study, you will not be able to reverse that decision later as your child's name will have been replaced in the project.



M. E. Jarrett, D.D.S., D.D.P.H.
Director of Dental Health
Waterloo County Health Unit

Please fill in the blank space that applies to you. Please Print.

I wish to have _____ included in the project.

Child's full name

Our family dentist is _____

Our address is _____

Birthdate of Child _____ Telephone Number _____

Signature of Parent or Guardian _____

If you have already filled in the above, disregard the next section.

I do not wish to have _____ included in the project.

Please state reason _____

Signature _____

WATERLOO COUNTY HEALTH UNIT

DENTAL DIVISION

Telephone Number 579-3120

THREE YEAR FREE DENTAL CARE PLAN

Dear Parent:

The Department of Health of Ontario is offering through the Waterloo County Health Unit a programme of preventive dental care for three-year-olds who have been selected by computer from the assessment roll of Waterloo County for 1971. Five hundred children have been selected for the programme.

has been one of the children selected.

These children will receive a free dental examination, Bite-Wing X-ray, a thorough cleaning of the teeth and an application of topical fluoride at their initial visit at the Health Unit, and an examination and topical fluoride treatment at six month intervals through ages three, four and five. Needed fillings and any other dental work will be at the parent's expense and the family dentist's convenience.

The bottom half of this sheet is for you to fill out. Consent of parent or guardian is required and the other spaces are for information necessary for our records and files.



M. E. Jarrett, D.D.S., D.D.P.H.
Director of Dental Health
Waterloo County Health Unit

Please fill in the blank space that applies to you. Please Print.

I wish to have _____ included in the project.
Child's full name

Our family dentist is _____

Our address is _____

Birthdate of child _____ Telephone Number _____

Signature of Parent or Guardian _____

If you have already filled in the above, disregard the next section.

I do not wish to have _____ included in the project.

Please state reason _____

Signature _____



850 KING STREET WEST, KITCHENER, ONTARIO, AREA 519 PHONE 744-7357

A FOUR YEAR TIME, COST AND MANPOWER STUDY OF INCREMENTAL DENTAL CARE FOR PRE-SCHOOL CHILDREN IN ONTARIO

This demonstration project is an incremental care program for delivery of comprehensive dental treatment to three year olds, and maintenance care through ages four and five. The program is designed to follow the guide lines proposed by the Ontario Council of Health, and it is similar to proposals advanced by the Hall Commission, and the Canadian and the Ontario Dental Associations. There are no known similar studies underway.

The Waterloo County Health Unit Staff will carry out the initial screening and dental health counselling for all study participants. And in some instances, will provide the bitewing radiographs and topical fluoride treatments. The remainder of the treatment will be completed by local private dental practitioners.

Four members of the Executive of the Waterloo-Wellington Dental Society will serve as dental advisors to the programme and will provide liaison between the private practitioners and the public health sector who will be administering the plan.

In the third and fourth years of the study, a blind assessment of all kindergarten children will be done to permit evaluation of dental health status of project participants and non-participants. The results of the project will be evaluated further to test the feasibility of a similar province-wide plan, including the cost and manpower estimates for such a programme.

APPENDIX B

FORMS SENT TO DENTISTS

A FOUR YEAR PLAN FOR INCREMENTAL DENTAL CARE IN WATERLOO COUNTY
FOR THREE YEAR OLDS

The incremental dental care plan briefly outlined on the attached sheet has been approved and will be funded by the Department of Health for Ontario. The plan calls for 1000 children aged three to be selected by random sample from the assessment roll of Waterloo County. The numbers drawn are to be in direct proportion to the 3 yr. olds living in each of the municipalities of the County. This will give a very good cross-section of the rural, urban, socio-economic, fluoride and non-fluoride area families with 3 year olds.

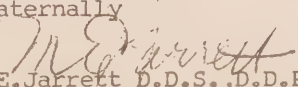
Bitewings are funded in only the first and third years of the study for each of the two groups to be selected, i.e. 1971 (1000); 1972 (1000). We are asking for one copy of the bitewings to be sent with your account, along with one copy of the duplicate chart that will be furnished for each child. For the purposes of this study, we are also asking for total chair time, and whether or not recall will be accepted, if not, why not. Your charges should be at your usual and customary fees; but, in no case more than the O.D.A. fees which are delineated on the duplicate charts. All accounts should be sent c/o Dr. M.E. Jarrett, 850 King Street West, Kitchener. They will be processed and paid from that office and hopefully we will be able to get the cheques out to you within a very few days after receipt of the account.

I realize that this will involve some extra work for your staff, but, if we are to make it a meaningful study, it has to be open to scrutiny, not only by the Department of Health, but by those from any other jurisdiction who may wish to assess either our results or our methodology. We believe that this is the first incremental care project ever to be initiated on a population cross-section, and will welcome any suggestions as to how our methodology may be improved.

A complete and up to date listing of all participating dentists will be maintained, so that those patients with no family dentist may have a choice, you will be equally free to reject any applicant for appointments.

I hope that you will wish to participate in this project, the attached form is for your signature either as a yes or a no. The return postage paid envelope is included for your convenience.

Fraternally


M.E. Jarrett D.D.S., D.D.P.H.



850 KING STREET WEST, KITCHENER, ONTARIO, AREA 519 PHONE 744-7357

Dear Dr.

The incremental dental care plan briefly outlined on the attached sheet has been approved and will be funded by the Dept. of Health, Ont. The plan calls for 1000 children aged three to be selected by random sampling from the assessment roll of Waterloo County. The numbers drawn are to be in direct proportion to the 3 yr. olds living in each of the municipalities of the County. This will give a very good cross-section of the rural, urban, socio-economic, fluoride and non-fluoride area families with 3 yr. olds.

Bitewings are funded in only the first and third years of the study for each of the two groups to be selected, (1000 in /71 and 1000 in /72. We are asking for 1 copy of the bitewings to be sent with your account, along with one copy of the duplicate chart which will be furnished for each child. For the purpose of this study, we are also asking for total chair time, whether or not recall will be accepted, and if not, why not. Your charges should be at your usual and customary fees, but, in no case more than O.D.A. fees which are printed on the duplicate charts. All accounts will be sent to 850 King St W. Kitchener, c/o Dr. M. E. Jarrett, I hope to be able to have them processed and cheques out within a few days of receipt of the accounts.

I realize that this will involve some extra work on the part of your office, but if we are to make it a meaningful study, it has to be open to any jurisdiction that may wish to examine and assess our methods or results. The dentists participating will each be given a code # and this will be the only identifying mark on the charts other than the patient's name. We believe that this is the first project of its kind on a population cross-section, and will welcome suggestions for improving methodology.

A complete and up to date list of participating dentists will be kept, so that patients with no family dentist may have a choice, you will be equally free to reject any applicant for appointments.

I hope that you will wish to participate in this project, your signature on the accompanying small form on the appropriate line. Return envelope is enclosed for your convenience. Fraternally . *Monte Jarrett*

I wish to be included in the panel of Dentists who will participate in the four year project "Incremental Dental Care for Three Year Olds".

YES _____

NO _____

ADDRESS _____ TEL. _____

APPENDIX C

PATIENT RECORD FORM

WATERLOO COUNTY PRE-SCHOOL INCREMENTAL DENTAL CARE STUDY

TREATED CHILD'S NAME: _____ BIRTHDATE: _____ SEX M ☐ F ☐
(Please print name in full) day/mon/yr

CHILD'S ADDRESS: _____
Street or Box Number Community

DENTIST'S NAME: _____
(Please Print)

DENTIST'S ADDRESS: _____
(Please Print in Full)

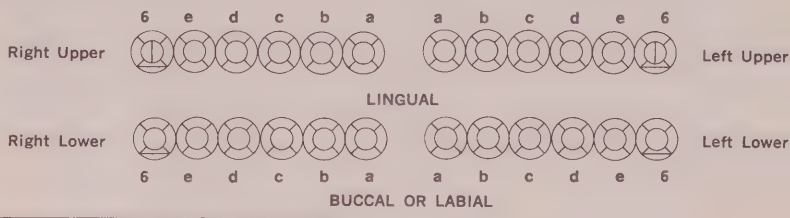
HEAD OFFICE ONLY	
Patient Code Number	
Dentist Code Number	
Date Statement Rec'd.	
Payment Authorized	Date

EXAMINATION RESULTS: (Please complete fully, as accurate, standardized records are essential to the study and processing of payments).

PARENT'S OCCUPATION _____

ETHNIC BACKGROUND _____

YEARS IN COUNTY _____



- ☐ Surface carious
- ☒ Surface restored
- ☐ Tooth absent with no successor in view
- ☒ Crown lost and/or tooth to be extracted
- ☐ IN Gingival Inflammation
- ☐ M Tooth mobility

INSTRUCTIONS:
 Please mark the relative size and shape of fillings. Use codes shown under tooth diagrams.

Space maintainer necessary for tooth space _____

Space maintainer placed ☐

OTHER:

ITEMIZED SERVICES RENDERED				
Date (day/mon/yr)	Diagnostic & Preventive	Submitted Fee		
	Examination Yes ☐ No ☐			
	Bitewings (2) Yes ☐ No ☐			
	Top Flouride Yes ☐ No ☐			
Date (day/mon/yr)	Tooth Symbol	Details of Service		
TOTAL FEE				

- PLEASE ANSWER EACH OF THE FOLLOWING:**
- About how long did all of the above dental service take: (Check one)

1 - 15 ☐
 16 - 30 ☐
 31 - 45 ☐
 46 - 60 ☐

61 - 75 ☐
 76 - 90 ☐
 91 - 105 ☐
 106 - 130 ☐

131 - 145 ☐
 146 - 160 ☐
 over 160 ☐
 - Is further treatment needed now? ☐ Yes — What _____
☐ No
 - Were purposed treatments for basic dental care accepted? ☐ No — Why _____
☐ Yes
 - Has patient been put on recall list? ☐ Yes ☐ No
 - Did patient break any appointments? ☐ Yes — How many? _____ ☐ No

THANK YOU - YOUR CO-OPERATION IS APPRECIATED. All of the above services have been rendered.

 Dentist's Signature

WATERLOO COUNTY PRE-SCHOOL INCREMENTAL DENTAL CARE STUDY

TREATED CHILD'S NAME: _____ BIRTHDATE: _____ SEX M ☐ F ☐
 (Please print name in full) day/mon/yr

CHILD'S ADDRESS: _____
 Street or Box Number Community

DENTIST'S NAME: _____
 (Please Print)

DENTIST'S ADDRESS: _____
 (Please Print in Full)

HEAD OFFICE ONLY	
Patient Code Number _____	
Dentist Code Number _____	
Date Statement Rec'd. _____	
Payment Authorized _____	Date _____

EXAMINATION RESULTS: (Please complete fully, as accurate, standardized records are essential to the study and processing of payments).

PARENT'S OCCUPATION _____

ETHNIC BACKGROUND _____

YEARS IN COUNTY _____

	6 e d c b a	a b c d e 6	
Right Upper			Left Upper
	LINGUAL		
Right Lower			Left Lower
	6 e d c b a	a b c d e 6	
	BUCCAL OR LABIAL		

- ☐ Surface carious
 ☐ Tooth absent with no successor in view
 ☒ Crown lost and/or tooth to be extracted
 ☐ Gingival Inflammation
 ☐ Tooth mobility

INSTRUCTIONS:

Please mark the relative size and shape of fillings. Use codes shown under tooth diagrams.

Space maintainer necessary for tooth space _____

Space maintainer placed ☐

OTHER:

ITEMIZED SERVICES RENDERED				
Date (day/mon/yr)	Diagnostic & Preventive	Submitted Fee		
	Examination Yes ☐ No ☐			
	Bitewings (2) Yes ☐ No ☐			
	Top Flouride Yes ☐ No ☐			
Date (day/mon/yr)	Tooth Symbol	Details of Service		
TOTAL FEE				

PLEASE ANSWER EACH OF THE FOLLOWING:

- About how long did all of the above dental service take: (Check one)

1 - 15 ☐	61 - 75 ☐	131 - 145 ☐
16 - 30 ☐	76 - 90 ☐	146 - 160 ☐
31 - 45 ☐	91 - 105 ☐	over 160 ☐
46 - 60 ☐	106 - 130 ☐	
- Is further treatment needed now? ☐ Yes — What _____
☐ No
- Were purposed treatments for basic dental care accepted? ☐ No — Why _____
☐ Yes
- Has patient been put on recall list? ☐ Yes ☐ No
- Did patient break any appointments? ☐ Yes — How many? _____ ☐ No

THANK YOU - YOUR CO-OPERATION IS APPRECIATED. All of the above services have been rendered.

Dentist's Signature _____

APPENDIX D

OTHER TREATMENT - SUPPLEMENTARY TABLES

LIST OF TABLES

- D.1 . Number of Teeth Extracted by Group and Year
- D.2 Number of Different Teeth Filled by Group and Year
- D.3 Number of One- Surface Fillings by Group and Year
- D.4 Number of Two-Surface Fillings by Group and Year
- D.5 Number of Three and Four-Surface Fillings and Full Crowns by Group and Year
- D.6 Total Number of Teeth Extracted Over All Years of Patients' Participation in the Program
- D.7 Total Number of Different Teeth Filled Over All Years of Patients' Participation in the Program
- D.8 Total Number of One-Surface Fillings Over All Years of Patients' Participation in the Program
- D.9 Total Number of Two-Surface Fillings Over All Years of Patients' Participation in the Program
- D.10 Total Number of Three and Four-Surface Fillings and Full Crowns Over All Years of Patients' Participation in the Program

TABLE D.1

NUMBER OF TEETH EXTRACTED BY GROUP AND YEAR

Number of Teeth Extracted	Group I						Group II					
	Year 1		Year 2		Year 3		Year 1		Year 2		Year 3	
	N	%	N	%	N	%	N	%	N	%	N	%
0	786	(97.2)	690	(94.1)	677	(88.5)	446	(97.2)	385	(96.7)	408	(92.9)
1	14	(1.7)	19	(2.6)	42	(5.5)	2	(0.4)	5	(1.3)	10	(2.3)
2	5	(0.6)	16	(2.2)	23	(3.0)	5	(1.1)	5	(1.3)	10	(2.3)
3+	4	(0.4)	8	(1.1)	23	(3.0)	6	(1.3)	3	(0.7)	11	(2.5)
TOTAL	809	(100)	733	(100)	765	(100)	459	(100)	398	(100)	439	(100)
MEAN	0.07		0.12		0.24		0.08		0.06		0.18	

TABLE D.2

NUMBER OF DIFFERENT TEETH FILLED BY GROUP AND YEAR

Number of Different Teeth Filled	Group I						Group II					
	Year 1		Year 2		Year 3		Year 1		Year 2		Year 3	
	N	%	N	%	N	%	N	%	N	%	N	%
0	525	(64.9)	418	(57.0)	316	(41.3)	370	(80.6)	243	(61.1)	282	(64.2)
1	44	(5.4)	84	(11.5)	96	(12.5)	16	(3.5)	35	(8.8)	38	(8.7)
2	51	(6.3)	78	(10.6)	114	(14.9)	17	(3.7)	33	(8.3)	47	(10.7)
3	31	(3.8)	46	(6.3)	69	(9.0)	13	(2.8)	24	(6.0)	23	(5.3)
4	35	(4.3)	41	(5.6)	63	(8.2)	12	(2.6)	20	(5.0)	17	(3.9)
5	26	(3.2)	18	(2.5)	31	(4.1)	5	(1.1)	16	(4.0)	10	(2.3)
6	30	(3.7)	16	(2.2)	35	(4.6)	7	(1.5)	6	(1.5)	11	(2.5)
7	16	(2.0)	11	(1.5)	18	(2.4)	4	(0.9)	8	(2.0)	4	(0.9)
8	18	(2.2)	12	(1.6)	10	(1.3)	6	(1.3)	6	(1.5)	4	(0.9)
9+	33	(4.1)	9	(1.2)	13	(1.7)	9	(2.0)	7	(1.8)	3	(0.7)
TOTAL	809	(100)	733	(100)	765	(100)	459	(100)	398	(100)	439	(100)
MEAN	1.60		1.35		1.94		0.80		1.37		1.08	

TABLE D.3

NUMBER OF ONE-SURFACE FILLINGS BY GROUP AND YEAR

Number of One- Surface Fillings	Group I						Group II					
	Year 1		Year 2		Year 3		Year 1		Year 2		Year 3	
	N	%	N	%	N	%	N	%	N	%	N	%
0	574	(71.0)	534	(72.9)	503	(65.8)	383	(83.4)	293	(73.6)	355	(80.9)
1	70	(8.7)	99	(13.5)	110	(14.4)	25	(5.4)	37	(9.3)	37	(8.4)
2	56	(6.9)	55	(7.5)	81	(10.6)	15	(3.3)	32	(8.0)	26	(5.9)
3	45	(5.6)	24	(3.3)	35	(4.6)	10	(2.2)	15	(3.8)	12	(2.7)
4	29	(3.6)	11	(1.5)	23	(3.0)	15	(3.3)	9	(2.3)	3	(0.7)
5	17	(2.1)	5	(0.7)	7	(0.9)	5	(1.1)	9	(2.3)	2	(0.5)
6	6	(0.7)	4	(0.5)	2	(0.3)	2	(0.4)	1	(0.3)	2	(0.5)
7+	12	(1.5)	1	(0.1)	4	(0.5)	4	(0.9)	2	(0.5)	2	(0.5)
TOTAL	809	(100)	733	(100)	765	(100)	459	(100)	398	(100)	439	(100)
MEAN	0.80		0.53		0.71		0.47		0.62		0.41	

TABLE D.4

NUMBER OF TWO-SURFACE FILLINGS BY GROUP AND YEAR

Number of Two- Surface Fillings	Group I						Group II					
	Year 1		Year 2		Year 3		Year 1		Year 2		Year 3	
	N	%	N	%	N	%	N	%	N	%	N	%
0	647	(80.0)	510	(69.6)	432	(56.5)	411	(89.5)	301	(75.6)	326	(74.3)
1	33	(4.1)	70	(9.5)	100	(13.1)	10	(2.2)	33	(8.3)	29	(6.6)
2	45	(5.6)	70	(9.5)	80	(10.5)	16	(3.5)	25	(6.3)	36	(8.2)
3	16	(2.0)	28	(3.8)	61	(8.0)	7	(1.5)	10	(2.5)	16	(3.6)
4	21	(2.6)	24	(3.3)	41	(5.4)	10	(2.2)	12	(3.0)	18	(4.1)
5	15	(1.9)	9	(1.2)	18	(2.4)	2	(0.4)	4	(1.0)	6	(1.4)
6	15	(1.9)	10	(1.4)	20	(2.6)	1	(0.2)	10	(2.5)	6	(1.4)
7+	17	(2.1)	12	(1.6)	13	(1.7)	2	(0.4)	3	(0.8)	2	(0.5)
TOTAL	809	(100)	733	(100)	765	(100)	459	(100)	398	(100)	439	(100)
MEAN	0.69		0.81		1.20		0.29		0.66		0.69	

TABLE D.5

NUMBER OF THREE- AND FOUR-SURFACE FILLINGS AND FULL CROWNS BY GROUP AND YEAR

Number of Three- and Four-Surface Fillings & Full Crowns	Group I						Group II					
	Year 1		Year 2		Year 3		Year 1		Year 2		Year 3	
	N	%	N	%	N	%	N	%	N	%	N	%
0	774	(95.7)	698	(95.2)	714	(93.3)	443	(96.5)	379	(95.2)	427	(97.3)
1	22	(2.7)	24	(3.3)	37	(4.8)	8	(1.7)	10	(2.5)	7	(1.6)
2	8	(1.0)	7	(1.0)	9	(1.2)	3	(0.7)	6	(1.5)	5	(1.1)
3	3	(0.4)	3	(0.4)	4	(0.5)	2	(0.4)	2	(0.5)	0	(0.0)
4	1	(0.1)	1	(0.1)	1	(0.1)	3	(0.7)	0	(0.0)	0	(0.0)
5	1	(0.1)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
6	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(0.3)	0	(0.0)
TOTAL	809	(100)	733	(100)	765	(100)	459	(100)	398	(100)	439	(100)
MEAN	0.07		0.07		0.09		0.07		0.09		0.04	

TABLE D.6

TOTAL NUMBER OF TEETH EXTRACTED OVER ALL YEARS
OF PATIENTS' PARTICIPATION IN THE PROGRAM

Total Number of Teeth Extracted	Group I		Group II		TOTAL	
	N	%	N	%	N	%
0	691	(83.9)	446	(90.5)	1,137	(86.3)
1	56	(6.8)	12	(2.4)	68	(5.2)
2	38	(4.6)	13	(2.6)	51	(3.9)
3	12	(1.5)	5	(1.0)	17	(1.3)
4	10	(1.2)	11	(2.2)	21	(1.6)
5+	17	(2.1)	6	(1.2)	23	(1.7)
TOTAL	824	(100)	493	(100)	1,137	(100)
MEAN	0.40		0.28		0.36	

TABLE D.7

TOTAL NUMBER OF DIFFERENT TEETH FILLED OVER ALL YEARS
OF PATIENTS' PARTICIPATION IN THE PROGRAM

Total Number of Different Teeth Filled	Group I		Group II		TOTAL	
	N	%	N	%	N	%
0	236	(28.6)	250	(50.7)	486	(36.9)
1	73	(8.9)	22	(4.5)	95	(7.2)
2	77	(9.3)	44	(8.9)	121	(9.2)
3	54	(6.6)	22	(4.5)	76	(5.8)
4	48	(5.8)	33	(6.7)	81	(6.2)
5	40	(4.9)	20	(4.1)	60	(4.6)
6-10	191	(23.2)	67	(13.6)	258	(19.6)
11-15	77	(9.3)	31	(6.3)	108	(8.2)
16-20	24	(2.9)	2	(0.4)	26	(2.0)
21+	4	(0.5)	2	(0.4)	6	(0.5)
TOTAL	824	(100)	493	(100)	1,317	(100)
MEAN	4.55		2.81		3.90	

TABLE D.8

TOTAL NUMBER OF ONE-SURFACE FILLINGS OVER ALL YEARS
OF PATIENTS' PARTICIPATION IN THE PROGRAM

Total Number of One- Surface Fillings	Group I		Group II		TOTAL	
	N	%	N	%	N	%
0	366	(44.4)	307	(62.3)	673	(51.1)
1	113	(13.7)	43	(8.7)	156	(11.8)
2	100	(12.1)	47	(9.5)	147	(11.2)
3	66	(8.0)	28	(5.7)	94	(7.1)
4	60	(7.3)	18	(3.7)	78	(5.9)
5	41	(5.0)	19	(3.9)	60	(4.6)
6	28	(3.4)	9	(1.8)	37	(2.8)
7+	50	(6.1)	22	(4.5)	72	(5.5)
TOTAL	824	(100)	493	(100)	1,317	(100)
MEAN	1.91		1.29		1.68	

TABLE D.9

TOTAL NUMBER OF TWO-SURFACE FILLINGS OVER ALL
YEARS OF PATIENTS' PARTICIPATION IN THE PROGRAM

Total Number of Two- Surface Fillings	Group I		Group II		TOTAL	
	N	%	N	%	N	%
0	378	(45.9)	311	(63.1)	689	(52.3)
1	67	(8.1)	33	(6.7)	100	(7.6)
2	82	(10.0)	44	(8.9)	126	(9.6)
3	44	(5.3)	14	(2.8)	58	(4.4)
4	59	(7.2)	31	(6.3)	90	(6.8)
5	36	(4.4)	13	(2.6)	49	(3.7)
6	42	(5.1)	16	(3.2)	58	(4.4)
7+	116	(14.1)	31	(6.3)	147	(11.2)
TOTAL	824	(100)	493	(100)	1,317	(100)
MEAN	2.49		1.42		2.09	

TABLE D.10

TOTAL NUMBER OF THREE- AND FOUR-SURFACE FILLINGS AND FULL CROWNS
OVER ALL YEARS OF PATIENTS' PARTICIPATION IN THE PROGRAM

Total Number of Three- and Four-Surface Fillings and Full Crowns	Group I		Group II		TOTAL	
	N	%	N	%	N	%
0	726	(88.1)	452	(91.7)	1,178	(89.4)
1	50	(6.1)	19	(3.9)	69	(5.2)
2	31	(3.8)	12	(2.4)	43	(3.3)
3	9	(1.1)	5	(1.0)	14	(1.1)
4	3	(0.4)	2	(0.4)	5	(0.4)
5	2	(0.2)	1	(0.2)	3	(0.2)
6	3	(0.4)	2	(0.4)	5	(0.4)
TOTAL	824	(100)	493	(100)	1,317	(100)
MEAN	0.22		0.17		0.20	

APPENDIX E

INDIVIDUAL DIFFERENCES AMONG PRIVATE DENTISTS

APPENDIX E

Individual Differences Among Private Dentists

It is clear that one factor determining the nature and extent of the dental treatment received by the children participating in the Waterloo incremental dental care program was differences in the practices of the individual private dentists who treated patients in the program. The study was not designed to analyze the performance of individual dentists. Many of the private dentists who participated in the program did not treat a sufficiently large number of patients to permit any analysis of their performance at all. In addition, since no evaluation of the dental health status of the children who were treated by the various private dentists is available, and since children were not randomly assigned to private dentists, there is no way of knowing to what extent differences in dental treatment reflect different patients' needs rather than different dentists' treatment practices. Nevertheless, it was decided to examine the performance of the ten private dentists with the highest level of participation in the program with a view to obtaining some idea of the extent to which individual differences among dentists were a factor determining the nature and extent of the dental treatment provided to children in the dental care program.

Table E.1 shows the percentage of patient-years in which patients received bitewing radiographs and topical fluoride applications; the percentage of patient-years in which patients in Groups I and II received

TABLE E.1
FOR SELECTED DENTISTS, PERCENTAGE OF PATIENT-YEARS WITH RADIOGRAPHS TAKEN,
TOPICAL FLUORIDE (INCLUDING PROPHY) APPLICATIONS, AND TREATMENT OTHER
THAN DIAGNOSTIC AND PREVENTIVE CARE, AND MEAN COST PER PATIENT-YEAR

Selected Dentists	Number of Patient Years	Percentage With Radiographs	Percentage With Topical Fluoride (including prophyl)	Percentage of Patients in Groups I and II with Other Treatment	Mean Cost Per Patient-Year
		%	%	%	\$
1	196	76.0	80.1	68.8	55.91
2	110	3.6	10.9	46.3	17.01
3	106	66.0	61.3	59.0	31.14
4	100	61.0	88.0	52.5	29.32
5	98	67.3	77.6	77.4	53.34
6	96	77.1	76.0	57.3	32.51
7	89	65.2	97.8	49.3	37.32
8	83	65.1	95.2	56.1	58.71
9	78	44.9	65.4	30.0	21.44
10	73	1.4	63.0	69.7	35.37
All Private Dentists	3,374	57.6	72.7	55.3	36.46

treatment other than basic diagnostic and preventive care; and the mean cost per patient-year. From this table, large individual differences among dentists emerge. It can be seen, for example, that the patients of two dentists almost never had radiographs taken while over three-quarters of the patients of two other dentists had them taken. There was also a wide range in the percentage of patients who received topical fluoride applications and in the percentage of patients in Groups I and II who received treatment other than basic diagnostic and preventive care. Corresponding differences in mean cost reflected, at least in part, different treatment levels on the part of different private dentists.

Table E.2 shows the mean number of examinations, radiographs,* and topical fluoride applications per patient-year for the same selected dentists and the estimated mean cost per patient-year for diagnostic and preventive care. The mean cost for diagnostic and preventive care by an individual dentist was estimated from the mean cost per patient-year for all the patients of that individual dentist who received diagnostic and preventive care only. Again, individual differences among dentists emerge, with costs reflecting different levels of treatment. The means for radiographs and topical fluorides show considerably more variation than the examination means.

Table E.3 presents data on treatment other than basic diagnostic and preventive care and the estimated cost for such treatment for the selected dentists. While extractions and fillings may reflect patient needs to a greater extent than examinations, radiographs, and topical fluoride applications, individual differences among dentists can be

* This refers to the mean number of times radiographs were taken and not the actual number of radiographs.

TABLE E.2
FOR SELECTED DENTISTS, MEAN NUMBER OF EXAMINATIONS, RADIOGRAPHS TAKEN, AND TOPICAL
FLUORIDE (INCLUDING PROPHY) APPLICATIONS, AND ESTIMATED MEAN COST FOR
DIAGNOSTIC AND PREVENTIVE CARE, PER PATIENT-YEAR

Selected Dentists	Mean # of Examinations Per Patient-Year	Mean # of Times Radiographs Were Taken Per Patient-Year	Mean # of Topical Fluoride (including prophy) Applications Per Patient-Year	Estimated Mean Cost for Diagnostic and Preventive Care Per Patient-Year*
				\$
1	1.19	0.91	1.00	21.16
2	1.38	0.04	0.11	7.18
3	1.51	0.71	0.67	14.33
4	1.43	0.66	1.27	16.72
5	1.35	0.79	0.95	21.70
6	1.28	0.88	0.90	17.30
7	1.27	0.84	1.20	20.44
8	1.52	0.68	1.46	23.26
9	1.40	0.47	0.73	14.68
10	1.34	0.01	0.67	12.56
All Private Dentists	1.36	0.67	0.92	17.52

* This figure was estimated by taking the mean cost for all patients receiving diagnostic and preventive care only.

TABLE E.3

FOR SELECTED DENTISTS, MEAN NUMBER OF EXTRACTIONS, DIFFERENT TEETH FILLED,
AND TOOTH SURFACES FILLED, AND ESTIMATED MEAN COST FOR TREATMENT
OTHER THAN DIAGNOSTIC AND PREVENTIVE CARE, PER PATIENT-YEAR (GROUPS I AND II ONLY)

Selected Dentists	Mean Number of Extractions Per Patient-Year	Mean Number of Different Teeth Filled Per Patient-Year	Mean Number of Tooth Surfaces Filled Per Patient-Year	Estimated Mean Cost For Treatment Other than Diagnostic and Preventive Care Per Patient-Year*
				\$
1	0.25	2.77	5.07	64.27
2	0.13	1.36	2.06	29.23
3	0.23	1.76	2.70	36.36
4	0.08	1.79	3.11	29.99
5	0.08	2.58	4.51	47.70
6	0.04	1.92	2.56	33.96
7	0.07	1.55	2.71	40.59
8	0.08	3.00	6.11	79.52
9	0.00	0.77	1.13	29.26
10	1.33	2.35	4.82	36.20
All Private Dentists	0.17	1.90	3.25	38.71

* This figure was estimated by subtracting the mean cost for patients receiving diagnostic and preventive care only, from the mean cost for patients receiving diagnostic and preventive care and other treatment.

observed. Cost for treatment other than basic care (estimated by subtracting the mean cost per patient-year for all the patients of an individual dentist who received diagnostic and preventive care only from the mean cost for those who received diagnostic and preventive care and other treatment) generally reflected the amount of treatment provided.

It is interesting to note that the dentists with the highest levels of diagnostic and preventive treatment also tended to have the highest levels of other treatment. Dentist "8", for example, had the highest mean number of examinations, topical fluorides, different teeth filled, and tooth surfaces filled of all ten selected dentists. Dentist "1" had the highest mean number of radiographs and the second highest mean number of extractions, teeth filled and surfaces filled. On the other hand, dentist "10", who had the lowest percentage of patients receiving radiographs, had by far the highest mean number of extractions.

Whether real differences in patients' treatment needs or different dentists' concepts of standards of essential treatment services or both lie behind these observed differences cannot be ascertained. It is clear however that some of these dentists, under identical rules for allowable diagnostic and preventive services, vary considerably in the degree to which they provide radiographs and topical fluorides, including prophylaxis.

APPENDIX F

PARENTS' OCCUPATION AND CHILDREN'S DENTAL CARE

APPENDIX F

Parents' Occupation and Children's Dental Care

It is commonly acknowledged that when children's dental care services are not provided free-of-charge, access to these services depends, at least in part, on parents' ability to pay. When cost is a determining factor, children from families of low socioeconomic status can generally be expected to receive less dental treatment than children from families of high socioeconomic status. In the case of the Waterloo incremental dental care plan, cost was eliminated as a factor determining the nature and extent of dental care services available to the children in Groups I and II. An attempt was made to investigate whether, even under these circumstances, socioeconomic status appeared to have an effect on the dental treatment received by participating children.

Parents' occupation was chosen as the indicator of families' socioeconomic status. The original version of the patient record form developed for the Waterloo incremental dental care study did not provide space for recording parent's occupation or ethnic background. A revised version of the form was developed and distributed after the first year of the study which did provide for the recording of this information (see Appendix C). Unfortunately, however, there was a very low rate of response to the request for this information and the data collected are too incomplete to be reported.

A special sub-study was undertaken to obtain information on parent's occupation for patients in Group II. Information was obtained from

Vernon's Kitchener and Waterloo (Ontario) Directory, 1973 and Vernon's Cambridge City Directory, 1973 and from telephone calls to those parents whose occupations were not listed in the Directory. Only one parent's occupation was recorded for each patient, presumably the father's in most cases.

An attempt was made to classify parent's occupations using the nine occupational prestige categories developed by Pineo and Porter.* In many cases, however, the information was not detailed enough to permit accurate classification. For example, it was not always possible to distinguish small officials from clerical workers, and semi-skilled from unskilled workers. It was therefore decided to group parents' occupations into three broader categories:

- 1) professionals, and large proprietors, managers and officials;
- 2) semi-professionals, and small proprietors, managers and officials, and clerical and sales;
- 3) skilled, semi-skilled and unskilled workers, and farmers.

It was felt that parents' occupations could be placed into these three categories with a fairly high degree of confidence.

* Peter C. Pineo and John Porter, "Occupational Prestige in Canada", The Canadian Review of Sociology and Anthropology, Volume 4, Number 1, February, 1967 pp. 24-40.

Table F.1-shows the mean total number* of: examinations; sets of radiographs; topical fluoride applications; teeth extracted and different teeth filled; and tooth surfaces filled; for patients whose parents fell into each of the three occupational categories.** The table indicates that while diagnostic and preventive services (examinations, bitewing radiographs, and topical fluorides) were more frequently provided to patients whose parents enjoyed higher occupational prestige, other treatment (extractions and fillings) was more often provided to patients from families of lower occupational prestige.*** Further investigation of the relationship between parents' socioeconomic status and the dental care received (or needed) by children should be done to examine social class differences in diet, oral hygiene practices, and parental attitudes towards dentists and dental care, as well as dentists' attitudes toward children from different social classes.

* This refers to the total over the entire course of patients' participation in the program.

** Data is presented for 425 cases only. No information on parental occupation could be obtained in 60 cases. In 8 cases, parents were not in the labour force -- 5 of these were students and 3 were housewives.

*** While Pineo and Porter found an almost clear gradient in the mean prestige scores for each of their nine categories, there was one exception -- the mean score for "clerical and sales" occupations and "skilled" occupations was almost identical. "Farmers" fell between "skilled" and "semi-skilled" workers in mean occupational prestige score.

TABLE F.1

MEAN TOTAL NUMBER OF EXAMINATIONS, TIMES BITEWING RADIOGRAPHS, WERE TAKEN
 APPLICATIONS OF TOPICAL FLUORIDE, TEETH EXTRACTED PLUS DIFFERENT TEETH FILLED,
 AND TOOTH SURFACES FILLED BY PARENT'S OCCUPATIONAL CATEGORY (GROUP II ONLY)

Parent's Occupational Category	Mean Total Number				
	Examinations	Times Bitewing Radiographs Were Taken	Applications of Topical Fluoride (including prophylaxis)	Teeth Extracted plus Different Teeth Filled	Tooth Surfaces Filled
Professionals; Large Proprietors, Managers and Officials (N = 70)	4.13	1.89	3.19	1.43	2.09
Semi-Professionals; Small Proprietors, Managers and Officials; Clerical and Sales (N = 142)	3.88	1.73	2.86	2.79	4.11
Skilled, Semi- Skilled, and Unskilled Workers; Farmers (N = 213)	3.58	1.59	2.78	4.10	6.17

APPENDIX G

SWAB SCORES AND DENTAL TREATMENT RECEIVED

APPENDIX G

Swab Scores and Dental Treatment Received

The children who participated in the Waterloo incremental dental care program were all to receive swab tests at the Health Unit at the time of their initial appointment.* The swab test, as developed by M.E.Jarrett and R.M.Grainger, involves the wiping of a cotton swab across the "necks" of the teeth in order to gather a sample of dental plaque, a substance associated with dental decay and gum disease. Subsequent incubation of the culture medium into which the swab is put brings about a colour change in the medium. The extent of the colour change is then scored on a meter to give the approximate pH of the material. It is hypothesized that the lower the pH, (i.e. the higher the acidity), the greater the likelihood that the person tested will get cavities unless dietary and oral hygiene changes are introduced.

The swab test is used routinely in the Waterloo Health Unit as a tool for patient education. It was decided to analyze the swab scores of the children participating in the Waterloo program to see if the test could also be used to predict patients' current and future dental treatment requirements. If the test proved to be a reliable predictor of treatment needs, it might be used to help determine whether a given child required dental examinations every six months or less frequently (e.g. yearly).

* Some Health Unit patients also received swab tests later on in the course of their participation in the program. Swab scores referred to in this appendix are the results of patients' first swab test in Year 1 of the program.

Table G.1 shows the distribution of swab scores in each group. The swab scores presented are the results of tests made in Year 1 of the program. No scores are available for patients taken directly to private dentists (thus by-passing the Health Unit), and for patients who did not appear for their first appointment until Year 2 or Year 3 of the program.* Swab scores are available for 558 (67.5%) of the 827 patients in Group I; 356 (71.9%) of the 495 patients in Group II; and 334 (73.7%) of the 453 patients in Group III.

Swab scores were divided into three categories: less than 4.3 -- low pH, high susceptibility to decay and need for treatment; 4.3 to 4.7 -- medium pH, medium susceptibility to decay and need for treatment; more than 4.7 -- high pH, low susceptibility to decay and need for treatment. In each group the smallest percentage of patients fell into the lowest pH (highest susceptibility) category and the largest percentage fell into the highest pH (lowest susceptibility) category. Patients in Group I tended to have slightly lower scores than patients in Groups II and III.

Table G.2 shows that patients who attended the Health Unit only in Year 1 (that is, those who were judged to be in need of no treatment other than basic diagnostic and preventive care), had higher swab scores than private patients. One would expect to find such a difference between two groups selected on the basis of need for treatment if the test was a true predictor of susceptibility to decay.

* Swab scores are also missing for a few patients who did have appointments at the Health Unit in Year 1.

TABLE G.1

YEAR 1 SWAB SCORE DISTRIBUTIONS

Group	Year 1 Swab Score							
	Less than 4.3		4.3 to 4.7		More than 4.7		TOTAL	
	N	%	N	%	N	%	N	%
I	93	(16.7)	152	(27.2)	313	(56.1)	558	(100)
II	47	(13.2)	68	(19.1)	241	(67.7)	356	(100)
III	44	(13.2)	57	(17.1)	233	(69.8)	334	(100)
TOTAL	184	(14.7)	277	(22.2)	787	(63.1)	1,248	(100)

TABLE G.2
DISTRIBUTION OF YEAR 1 SWAB SCORES FOR HEALTH UNIT AND PRIVATE PATIENTS

GROUP	Health Unit Patients										Private Patients													
	Year 1 Swab Score										Year 1 Swab Score													
	Less than 4.3			4.3 to 4.7			More than 4.7			TOTAL			Less than 4.3			4.3 to 4.7			More than 4.7			TOTAL		
	N	%		N	%		N	%		N	%		N	%		N	%		N	%		N	%	
I	27	(9.7)		78	(28.1)		173	(62.2)		278	(100)		66	(23.6)		74	(26.4)		140	(50.0)		280	(100)	
II	22	(8.9)		43	(17.5)		181	(73.6)		246	(100)		25	(22.7)		25	(22.7)		60	(54.5)		110	(100)	
III	27	(10.7)		42	(16.6)		184	(72.7)		253	(100)		17	(21.0)		15	(18.5)		49	(60.5)		81	(100)	
TOTAL	76	(9.8)		163	(21.0)		538	(69.2)		777	(100)		108	(22.9)		114	(24.2)		249	(52.9)		471	(100)	

The availability of actual treatment records for patients in Groups I and II permitted further investigation of the relationship between Year 1 swab scores and treatment needs during Year 1 and also during Years 2 and 3. Tables G.3 and G.4 demonstrate that those patients with swab scores higher than 4.7 in Year 1 required relatively little care that year in terms of teeth extracted or filled and tooth surfaces filled as compared to those with low scores (less than 4.3). In Group I Year 1, patients in the low swab score category had a mean of 4.18 teeth extracted or filled and 7.41 tooth surfaces filled while patients in the high swab score category had a mean of 0.58 teeth extracted or filled and 0.89 tooth surfaces filled. In Group II Year 1, patients in the low swab score category had a mean of 2.26 teeth extracted or filled and 3.55 tooth surfaces filled while patients in the high swab score category had a mean of 0.21 teeth extracted or filled and 0.32 tooth surfaces filled. The percentage requiring no fillings or extractions in Group I year 1 was 31.2% in the low swab score category compared to 82.7% in the high swab score category. In Group II Year 1 the figures are 59.6% and 93.4%, respectively.

The potential usefulness of the swab test (in addition to its recognized value as a patient education tool), depends on its ability to predict treatment needs in later years. Year 1 swab scores were therefore analyzed in relation to treatment received in Years 2 and 3 of the program. These data are presented in Tables G.5, G.6, G.7 and G.8. The ability of the swab test to discriminate among patients receiving different levels of dental treatment generally held up in Years 2 and 3. In Group I Year 2, 69.1% of the patients in the highest swab score category required no fillings or

TABLE G.3
DISTRIBUTION OF NUMBER OF TEETH EXTRACTED
PLUS DIFFERENT TEETH FILLED IN YEAR 1 BY YEAR 1 SWAB SCORE

Number of Extractions Plus Different Teeth Filled	Year 1 Swab Score											
	Group I Year 1						Group II Year 1					
	Less than 4.3		4.3 to 4.7		More than 4.7		Less than 4.3		4.3 to 4.7		More than 4.7	
	N	%	N	%	N	%	N	%	N	%	N	%
0	29	(31.2)	99	(65.1)	259	(82.7)	28	(59.6)	51	(75.0)	225	(93.4)
1	2	(2.2)	12	(7.9)	14	(4.5)	2	(4.3)	2	(2.9)	4	(1.7)
2	9	(9.7)	12	(7.9)	10	(3.2)	3	(6.4)	2	(2.9)	4	(1.7)
3	4	(4.3)	4	(2.6)	8	(2.6)	2	(4.3)	4	(5.9)	3	(1.2)
4	10	(10.8)	4	(2.6)	8	(2.6)	4	(8.5)	2	(2.9)	1	(0.4)
5	7	(7.5)	4	(2.6)	4	(1.3)	0	(0.0)	3	(4.4)	1	(0.4)
6	10	(10.8)	5	(3.3)	4	(1.3)	0	(0.0)	1	(1.5)	1	(0.4)
7	4	(4.3)	3	(2.0)	2	(0.6)	1	(2.1)	1	(1.5)	2	(0.8)
8	5	(5.4)	4	(2.6)	2	(0.6)	1	(2.1)	2	(2.9)	0	(0.0)
9	4	(4.3)	1	(0.7)	2	(0.6)	4	(8.5)	0	(0.0)	0	(0.0)
10+	9	(9.7)	4	(2.6)	0	(0.0)	2	(4.3)	0	(0.0)	0	(0.0)
TOTAL	93	(100)	152	(100)	313	(100)	47	(100)	68	(100)	241	(100)
MEAN	4.18		1.47		0.58		2.26		1.03		0.21	

TABLE G.4

DISTRIBUTION OF NUMBER OF TOOTH SURFACES
FILLED IN YEAR 1 BY YEAR 1 SWAB SCORE

Number of Tooth Surfaces Filled	Year 1 Swab Score											
	Group I Year 1				Group II Year 1							
	Less than 4.3		4.3 to 4.7		More than 4.7		Less than 4.3		4.3 to 4.7		More than 4.7	
	N	%	N	%	N	%	N	%	N	%	N	%
0	29	(31.2)	99	(65.1)	259	(82.7)	30	(63.8)	51	(75.0)	225	(93.4)
1	1	(1.1)	10	(6.6)	11	(3.5)	2	(4.3)	2	(2.9)	2	(0.8)
2	6	(6.5)	9	(5.9)	10	(3.2)	3	(6.4)	0	(0.0)	3	(1.2)
3	5	(5.4)	4	(2.6)	5	(1.6)	0	(0.0)	1	(1.5)	3	(1.2)
4	4	(4.3)	7	(4.6)	7	(2.2)	2	(4.3)	2	(2.9)	3	(1.2)
5	1	(1.1)	2	(1.3)	2	(0.6)	1	(2.1)	4	(5.9)	1	(0.4)
6-10	23	(24.7)	10	(6.6)	12	(3.8)	2	(4.3)	7	(10.3)	1	(0.4)
11-15	14	(15.1)	5	(3.3)	6	(1.9)	2	(4.3)	1	(1.5)	3	(1.2)
16-20	4	(4.3)	4	(2.6)	0	(0.0)	4	(8.5)	0	(0.0)	0	(0.0)
21+	6	(6.5)	2	(1.3)	1	(0.3)	1	(2.1)	0	(0.0)	0	(0.0)
TOTAL	93	(100)	152	(100)	313	(100)	47	(100)	68	(100)	241	(100)
MEAN	7.41		2.30		0.89		3.55		1.56		0.32	

TABLE G.5
DISTRIBUTION OF NUMBER OF TEETH EXTRACTED
PLUS DIFFERENT TEETH FILLED IN YEAR 2 BY YEAR 1 SWAB SCORE

Number of Extractions Plus Different Teeth Filled	Year 1 Swab Score											
	Group I Year 2						Group II Year 2					
	Less than 4.3			4.3 to 4.7			More than 4.7			Less than 4.3		
	N	%		N	%		N	%		N	%	
0	27	(32.1)		66	(48.9)		190	(69.1)		12	(35.3)	
1	13	(15.5)		15	(11.1)		23	(8.4)		4	(11.8)	
2	9	(10.7)		17	(12.6)		22	(8.0)		5	(14.7)	
3	7	(8.3)		10	(7.4)		14	(5.1)		5	(14.7)	
4	7	(8.3)		6	(4.4)		10	(3.6)		0	(0.0)	
5	3	(3.6)		5	(3.7)		5	(1.8)		3	(8.8)	
6	6	(7.1)		6	(4.4)		3	(1.1)		1	(2.9)	
7	2	(2.4)		4	(3.0)		3	(1.1)		0	(0.0)	
8	5	(6.0)		2	(1.5)		3	(1.1)		2	(5.9)	
9	3	(3.6)		1	(0.7)		2	(0.7)		1	(2.9)	
10+	2	(2.4)		3	(2.2)		0	(0.0)		1	(2.9)	
TOTAL	84	(100)		135	(100)		275	(100)		34	(100)	
MEAN	2.79			1.92			0.93			2.62		
										1.79		
										0.88		

TABLE G.6

DISTRIBUTION OF NUMBER OF TOOTH SURFACES FILLED
IN YEAR 2 BY YEAR 1 SWAB SCORE

APPENDIX G-9

Number of Tooth Surfaces Filled	Year 1 Swab Score										
	Group I Year 2					Group II Year 2					
	Less than 4.3		4.3 to 4.7		More than 4.7	Less than 4.3		4.3 to 4.7		More than 4.7	
	N	%	N	%	N	N	%	N	%	N	%
0	28	(33.3)	69	(51.1)	195	13	(38.2)	32	(55.2)	147	(73.5)
1	7	(8.3)	8	(5.9)	13	3	(8.8)	3	(5.2)	9	(4.5)
2	6	(7.1)	9	(6.7)	17	2	(5.9)	3	(5.2)	11	(5.5)
3	9	(10.7)	7	(5.2)	10	3	(8.8)	2	(3.4)	4	(2.0)
4	3	(3.6)	12	(8.9)	9	4	(11.8)	5	(8.6)	6	(3.0)
5	6	(7.1)	7	(5.2)	3	3	(8.8)	3	(5.2)	4	(2.0)
6-10	12	(14.3)	13	(9.6)	18	3	(8.8)	4	(6.9)	14	(7.0)
11-15	7	(8.3)	6	(4.4)	8	0	(0.0)	5	(8.6)	3	(1.5)
16-20	6	(7.1)	4	(3.0)	2	1	(2.9)	1	(1.7)	2	(1.0)
21+	0	(0.0)	0	(0.0)	0	2	(5.9)	0	(0.0)	0	(0.0)
TOTAL	84	(100)	135	(100)	275	34	(100)	58	(100)	200	(100)
MEAN	4.37		2.87		1.43	3.77		2.81		1.37	

TABLE G.7

DISTRIBUTION OF NUMBER OF TEETH EXTRACTED PLUS DIFFERENT
TEETH FILLED IN YEAR 3 BY YEAR 1 SWAB SCORE

Number of Extractions Plus Different Teeth Filled	Year 1 Swab Score									
	Group I Year 3				Group II Year 3					
	Less than 4.3		4.3 to 4.7		More than 4.7		Less than 4.3		4.3 to 4.7	
	N	%	N	%	N	%	N	%	N	%
0	14	(16.9)	50	(35.2)	129	(44.9)	21	(55.3)	29	(47.5)
1	5	(6.0)	23	(16.2)	36	(12.5)	7	(18.4)	6	(9.8)
2	15	(18.1)	20	(14.1)	35	(12.2)	4	(10.5)	8	(13.1)
3	14	(16.9)	15	(10.6)	24	(8.4)	2	(5.3)	4	(6.6)
4	16	(19.3)	7	(4.9)	22	(7.7)	3	(7.9)	7	(11.5)
5	6	(7.2)	7	(4.9)	11	(3.8)	0	(0.0)	2	(3.3)
6	2	(2.4)	6	(4.2)	11	(3.8)	1	(2.6)	1	(1.6)
7	5	(6.0)	4	(2.8)	6	(2.1)	0	(0.0)	0	(0.0)
8	2	(2.4)	3	(2.1)	4	(1.4)	0	(0.0)	3	(4.9)
9	1	(1.2)	2	(1.4)	4	(1.4)	0	(0.0)	0	(0.0)
10+	3	(3.6)	5	(3.5)	5	(1.7)	0	(0.0)	1	(1.6)
TOTAL	83	(100)	142	(100)	287	(100)	38	(100)	61	(100)
MEAN	3.35		2.37		1.92		1.03		1.87	
									1.05	

TABLE G.8
DISTRIBUTION OF NUMBER OF TOOTH SURFACES
FILLED IN YEAR 3 BY YEAR 1 SWAB SCORE

Number of Tooth Surfaces Filled	Year 1 Swab Score											
	Group I Year 3						Group II Year 3					
	Less than 4.3		4.3 to 4.7		More than 4.7		Less than 4.3		4.3 to 4.7		More than 4.7	
	N	%	N	%	N	%	N	%	N	%	N	%
0	15	(18.1)	55	(38.7)	134	(46.7)	25	(65.8)	32	(52.5)	150	(67.6)
1	2	(2.4)	11	(7.7)	20	(7.0)	2	(5.3)	2	(3.3)	7	(3.2)
2	8	(9.6)	16	(11.3)	27	(9.4)	5	(13.2)	7	(11.5)	15	(6.8)
3	7	(8.4)	7	(4.9)	12	(4.2)	1	(2.6)	3	(4.9)	7	(3.2)
4	11	(13.3)	12	(8.5)	23	(8.0)	1	(2.6)	4	(6.6)	14	(6.3)
5	3	(3.6)	5	(3.5)	7	(2.4)	1	(2.6)	3	(4.9)	3	(1.4)
6-10	28	(33.7)	19	(13.4)	44	(15.3)	2	(5.3)	7	(11.5)	17	(7.7)
11-15	7	(8.4)	13	(9.2)	12	(4.2)	1	(2.6)	2	(3.3)	7	(3.2)
16-20	2	(2.4)	3	(2.1)	7	(2.4)	0	(0.0)	1	(1.6)	2	(0.9)
21+	0	(0.0)	1	(0.7)	1	(0.3)	0	(0.0)	0	(0.0)	0	(0.0)
TOTAL	83	(100)	142	(100)	287	(100)	38	(100)	61	(100)	222	(100)
MEAN	5.36		3.68		3.05		1.29		2.59		1.67	

extractions compared to 32.1% in the lowest category. In Group II Year 2 the figures were 73.5% and 35.3%, respectively. In Group I Year 3, 44.9% of the patients in the highest swab score category required no fillings or extractions compared to 16.9% in the lowest category. Corresponding figures for Group II Year 3 were 67.1% and 55.3%. These results indicate that in Group II Year 3 the differences between the high and low swab score categories were considerably diminished. Moreover, in Group II Year 3, the medium swab score category had the highest mean number of teeth extracted or filled and tooth surfaces filled. Further statistical analysis is required to investigate whether the Year 1 swab score could be combined with other variables (e.g. treatment required in Year 1) to develop a more accurate predictor of future treatment needs in young children.

APPENDIX H

WATER FLUORIDATION AND DENTAL TREATMENT NEEDS

APPENDIX H

Water Fluoridation and Dental Treatment Needs

The incremental dental care project was not specifically designed to investigate the relationship between children's dental treatment needs and water fluoridation. Nevertheless, an attempt was made to explore the nature of this relationship using data that were collected during the course of the project. There were several problems involved.

Data were not available on treatment needs as such, but only on services rendered and billed to the dental care plan. Since reparative treatment was not covered under the plan for patients in Group III, no information is available on the treatment received by patients in that group. Problems also arise from the fact that dental treatment received is not simply a function of the need for treatment but also involves other factors such as individual differences in the practices of private dentists (see Appendix E).

Only a small percentage of the total sample resided in areas with fluoridated water. Two areas of Waterloo Region had fluoridated water at the time the project was being conducted - the City of Waterloo and Wellesley Village. Of 824 patients in Group I, 115 (14.0%) resided in the City of Waterloo and 8 (1.0%) resided in Wellesley Village at the time of their initial appointment under the dental care plan. In Group II, 61 (12.4%) of 493 patients resided in the City of Waterloo and 2 (0.4%) resided in Wellesley Village.

Tables H.1 and H.2 show the distribution of the number of teeth extracted plus different teeth filled and the number of tooth surfaces filled per year for patients residing in the City of Waterloo and elsewhere. Patients were counted once for each year they appeared in the study and place of residence was determined for each year in which the patient appeared. For example, a patient who appeared in all three years of the program and who was a Waterloo resident in Year 1 and a Cambridge resident in Years 2 and 3 would be counted three times - once as a Waterloo resident and twice as an "other" resident. Waterloo residents were exposed to water fluoridation while other residents were not.* It appears from Tables H.1 and H.2 that water fluoridation is associated with fewer cavities since the mean treatment received is about 28% to 34% less in Waterloo children than in children residing outside of Waterloo.

No information was available as to how long patients had lived in the areas in which they were residing at the beginning of their participation in the dental care program. It is known that patients changed their place of residence from fluoridated to non-fluoridated areas over the course of their participation in the program. Even when families did not change their place of residence, it is likely that there was considerable movement between fluoridated and non-fluoridated areas (e.g. between Kitchener and Waterloo which are contiguous cities). In addition, children from both fluoridated and non-fluoridated areas saw the same private dentists and attended the Health Unit. All these factors would tend to mask any differences between the

* Residents of Wellesley Village, a fluoridated area, were included in the "other resident" category. Of the 3,081 "other residents" (patients were counted once for each appearance), only 28 were from Wellesley Village. The inclusion of these patients in the "other" category would, therefore, have a very small effect on the results.

TABLE H.1

DISTRIBUTION OF NUMBER OF TEETH EXTRACTED PLUS DIFFERENT TEETH FILLED
 PER YEAR FOR PATIENTS RESIDING IN THE CITY OF WATERLOO AND ELSEWHERE
 (Groups I and II, Years 1, 2 and 3 together)

Number of Teeth Extracted Plus Different Teeth Filled	Waterloo Residents		Other Residents	
	N	%	N	%
0	343	(65.7)	1,768	(57.4)
1	46	(8.8)	269	(8.7)
2	61	(11.7)	278	(9.0)
3	17	(3.3)	188	(6.1)
4	15	(2.9)	176	(5.7)
5+	40	(7.7)	402	(13.0)
TOTAL	522	(100)	3,081	(100)
MEAN	1.07		1.64	

TABLE H.2

DISTRIBUTION OF NUMBER OF TOOTH SURFACES FILLED
 PER YEAR FOR PATIENTS RESIDING IN THE CITY OF WATERLOO AND ELSEWHERE
 (Groups I and II, Years 1, 2, and 3 together)

Number of Tooth Surfaces Filled	Waterloo Residents		Other Residents	
	N	%	N	%
0	347	(66.5)	1,807	(58.6)
1	25	(4.8)	157	(5.1)
2	43	(8.2)	209	(6.8)
3	23	(4.4)	107	(3.5)
4	28	(5.4)	177	(5.7)
5	5	(1.0)	83	(2.7)
6-10	28	(5.4)	325	(10.5)
11-15	15	(2.9)	137	(4.4)
16-20	5	(1.0)	54	(1.8)
21+	3	(0.6)	25	(0.8)
TOTAL	522	(100)	3,081	(100)
MEAN	1.68		2.57	

treatment needs of patients residing in the City of Waterloo and those residing in other, non-fluoridated areas. Thus, the true effect of water fluoridation without these confounding factors is probably greater than appears here.

APPENDIX I

FOLLOW-UP STUDY

APPENDIX I

Follow-Up Study

In the Region of Waterloo, dental health surveys of the population of the junior grades in the elementary schools are conducted by dental hygienists from the Health Unit. Data obtained from these surveys in 1973-74 and 1974-75 are presented here (see Tables I.1 and I.2) in order to examine differences in dental health among children belonging to the different project groups and between those children who participated in the project and those who did not. Unfortunately, because of staff shortages all schools were not surveyed. This partially explains the small study group samples available for follow-up. The comparisons between project and non-project children are complicated by the fact that the initial age range of project children, especially in Group I, resulted in their being in two successive school grades. Nevertheless a number of qualified comparisons are possible.

Children from Group I were in both kindergarten and grade 1 in 1973-1974. In 1974-75 children from Group 1 were in grades 1 and 2. The information in Tables I.1 and I.2 suggests that Group I children have similar numbers of primary teeth attacked by decay (def) but higher levels of treatment for decay than their peers who did not participate in the program. Non-project children did get dental care as demonstrated by the percentage of the attacked (def) teeth that were extracted or filled; however, with Group I project children the proportion of attacked teeth that were extracted or filled was about 30% higher both in 1973-74 and 1974-75.

Some Group II and III children were in kindergarten in 1973-74 and most of them were in kindergarten or grade 1 in 1974-75. Both Groups II and III

TABLE I.1
1973-74, WATERLOO REGION DENTAL PUBLIC HEALTH SURVEY DATA

Group	N	ND %	PT %	R %	Neg %	def	e %	tbl %	d %	f %	DMF
1. I	693	62.8	20.2	11.7	5.3	3.65	6.2	0.7	14.3	78.8	.18
2. Grade 1 (non project)	3871	45.1	17.5	7.6	29.7	3.70	8.7	6.1	40.0	45.2	.24
3. Kindergarten (non project)	4119	50.6	11.9	9.4	28.1	2.77	6.1	4.5	47.2	42.2	.02
4. II	142	64.1	14.8	12.7	8.5	2.77	6.6	2.3	21.1	70.1	.00
5. III	150	72.7	11.3	7.3	8.7	2.08	1.3	0.0	24.0	74.7	.00

N Sample size

ND No Dental Defects. Percentage of children having caries, periodontal and orthodontic treatment completed or never needed (with oral hygiene ignored).

PT Partial Restorative Treatment. Percentage of children with some but incomplete restorative treatment.

R No Caries Defects. Percentage of children having caries treatment completed or never needed and periodontal, orthodontic or oral hygiene conditions may be faulty.

Neg Neglect. Percentage of children with no evidence of having received caries treatment although it is needed or for whom treatment is still incomplete and has so far involved only extractions.

def Average number of decayed, prematurely missing, indicated for extraction or restored deciduous teeth or tooth crowns per child.

e Percentage of def teeth which are extracted.

tbl Percentage of def teeth which are to be lost due to dental caries because of an abscess or less than one-third of the crown remaining.

d Percentage of def teeth which are decayed.

f Percentage of def teeth which are filled.

DMF Average number of decayed, missing, indicated for extraction or restored permanent teeth or tooth crowns per child.

TABLE I.2
1974-75 WATERLOO REGION DENTAL PUBLIC HEALTH SURVEY DATA

Group	N	ND %	PT %	R %	Neg %	def	e %	tbl %	d %	f %	DMF
1. I	621	57.7	21.6	16.9	3.9	3.83	8.0	0.9	7.8	83.3	.58
2. Grade 2 (non project)	3688	39.7	21.7	13.6	25.0	3.81	13.2	5.8	27.8	53.2	.62
3. Grade 1 (non project)	4120	48.5	14.9	9.9	26.7	3.39	9.1	5.4	32.7	52.9	.20
4. Kindergarten (non project)	3317	45.1	10.8	12.3	31.7	2.95	5.3	3.8	42.3	48.7	.02
5. II	377	65.3	13.0	13.0	8.8	2.86	11.6	1.4	14.1	72.9	.06
6. III	350	67.4	9.4	16.0	7.1	2.47	2.9	0.0	11.7	85.4	.06

N Sample size

ND No Dental Defects. Percentage of children having caries, periodontal and orthodontic treatment completed or never needed (with oral hygiene ignored).

PT Partial Restorative Treatment. Percentage of children with some but incomplete restorative treatment.

R No Caries Defects. Percentage of children having caries treatment completed or never needed and periodontal, orthodontic or oral hygiene conditions may be faulty.

Neg Neglect. Percentage of children with no evidence of having received caries treatment although it is needed or for whom treatment is still incomplete and has so far involved only extractions.

def Average number of decayed, prematurely missing, indicated for extraction or restored deciduous teeth or tooth crowns per child.

e Percentage of def teeth which are extracted.

tbl Percentage of def teeth which are to be lost due to dental caries because of an abscess or less than one-third of the crown remaining.

d Percentage of def teeth which are decayed.

f Percentage of def teeth which are filled.

DMF Average number of decayed, missing, indicated for extraction or restored permanent teeth or tooth crowns per child.

also show improved treatment levels over the appropriate comparison groups of non-project children to about the same degree the Group I children did. It should be emphasized that Group III children received only preventive and diagnostic services under the plan.

The comparison between Groups II and III in each of the school years covered by Tables I.1 and I.2 indicates, surprisingly, that Group III children who had diagnostic and preventive care only funded under the plan were slightly better off in both numbers of teeth decayed and treatment received than Group II children who received diagnostic and preventive care and other dental treatment under the plan. In the discussion of the implications of these findings it is essential to emphasize two factors. Firstly, the dental hygienists' examinations were of the 'screening' variety in school facilities and did not involve radiographs or the special light and chair found in a dental office. Secondly, the dental hygienists did not know to which group (project or non-project) the children belonged at the time of examination. Therefore, the number of teeth recorded as decayed or filled is probably low overall but unbiased as to the group from which the child came. As mentioned earlier, all project children were not included in this analysis for a reason unconnected with this study, but since non-project children were eliminated for the same reason, it is not likely that this introduced bias.

The results of the follow-up study suggest that the children subsidized for diagnostic and preventive care only managed to receive the additional care required (at their parents' expense) to a slightly higher level than children whose care was totally subsidized. Apparently the partial care

received under the plan was the main stimulus for completion of care because the 'control' children not participating in the plan received a noticeably lower level of treatment for decayed teeth. It is highly probable that many of the non-project children did not receive even diagnostic and preventive care on a regular basis.*

The value of the plan is roughly measured as the difference between the project and non-project children in the number of decayed teeth and treatment achieved. There is little difference between the project and non-project children in relation to the average total number of decayed teeth (def). The marginal gain due to the program of about 30% more decayed teeth which are filled is the main obvious measurable benefit of the program. This is roughly one more decayed tooth becoming filled per child. Other, less obvious benefits such as relatively greater continuation of the use of dental services may accrue but cannot be determined by this study. It must be remembered that the Waterloo Region is relatively affluent and dentally aware, with good accessibility to care.

In summary, the results of this less-than-detailed follow-up study indicate that children receiving subsidized care in an area relatively well-supplied with dentists have somewhat better dental health than children not so subsidized. Because of the limitations in the design of this follow-up study, these results must be treated with great caution and require further investigation.

* The fact that children whose parents were paying for restorative treatment apparently received a higher level of care than children whose dental treatment was totally subsidized may also be a reflection of some dentists' attitudes towards "public" as opposed to "private" patients.

